THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. AUGUST 10, 1893. CHICAGO, ILL. NUMBER 32.

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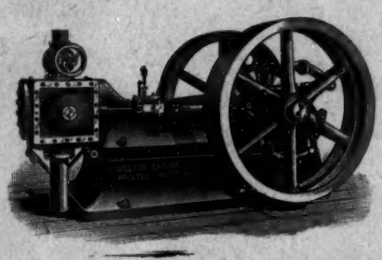

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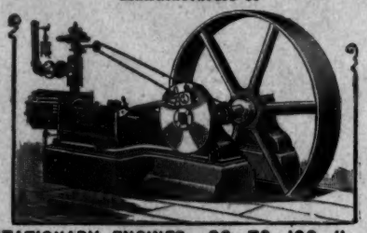

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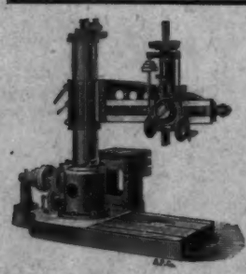

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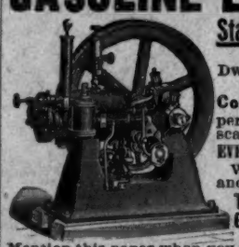

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THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. AUGUST 10, 1893. CHICAGO, ILL. NUMBER 32.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The monotony of shut-downs in all departments of iron manufacture and in industries furnishing the demand for crude and finished iron, has gone on unbroken for another week. The monetary mending expected of Congress is the hinge upon which everything is to turn, in the general thinking, and the fact that there has been everywhere a waiting "until Congress meets" makes sure that much of the waiting will continue until Congress does something. Thus the situation is as problematic as ever. President Cleveland hints at what has found expression in much more decided terms from various manufacturers, when he says in his message that "it may be true that the embarrassments from which the country is suffering arise as much from evils apprehended as from those actually existing;" and if only there were the assurance that the "evils apprehended" by conservative manufacturers will not come, there might be some contracting looking beyond the immediate future. But dominating the whole situation to day is the continuing inability of manufacturers to get money to carry on operations. At Pittsburg the banks would view any general starting of mills with apprehension, even were there orders to warrant it, since the drain of currency for pay rolls would present a serious problem. In the raw iron market the story is repeated, of a continually restricted demand, and little has been done outside of a few sales of Southern iron. The banking of furnaces in the valleys and in the Pittsburg district continues; and the impossibility of making deliveries on contracts will add to the inactive list until the turn comes. Foundry operations are irregular; here and there a foundry is fully employed on contract work and now and then a resumption is announced, but the general tendency is in the other direction. In nearly every industry working in iron a reduction from 10 to 15 per cent. in wages has been made and in most instances employes are accepting the situation in a reasonable spirit. In Pittsburg the question as far as the employes are concerned, is no longer whether they can secure recognition of the union, but how many of them shall have a chance to work the coming fall and winter. Pittsburg mills, such as have made terms with their employes, are running with small forces, manufacturing just what orders require. Buyers everywhere find that they can make unheard of terms, if they can promise prompt cash, but the number of those who can comply is limited. As an index of the depression in pig iron, warrant yard stocks increased in July, 2,200 tons being put in yard in the three weeks following the 10th, while 500 tons were withdrawn. The total Aug. 1, was 78,300 tons, the largest on record.

THE CLEVELAND OUTLOOK.

The reductions of force at Lake Superior mines in the past week have brought operations very close to the complete standstill predicted six weeks ago. The Lake Superior has laid off more men; the Lake Angeline, last of all to make any reduction, has dropped about 10 per cent of its force and made a cut in wages. On the Mesabi range inability to get money has stopped work at the Biwabik and Hale. At the Commodore and Franklin shipping continues, both mines having made fair sales, that of the former being the result of a rail deal made early in the season. In connection with the Schlesinger properties, plans are on foot that will result in their transfer to the original holders or to the creditors of Ferdinand Schlesinger and associates. The deal in connection with the Chapin provides for the giving of a first mortgage on the property to the Milwaukee banks which have made large advances, this mortgage covering mining machinery, stock piles, lease, and the mine itself; a second mortgage to the fee owners, and a third mortgage to the Northwestern Railroad Co. The proceeding means the handing of the mine over to creditors for operation until present indebtedness is wiped out. The freight market has dragged on at the same old pace, the only change being that some of the threats of tying up are being carried into effect this week, in the case of a score or more of boats. The few charters made are at 45 cents Escanaba, and 50 cents Lake Superior points. Nothing is reported in contracts except one engagement made some time ago for 20,000 tons from Marquette at 60 cents.

Pig Iron. The decision of blast furnace operators in the valleys to reduce the wages of furnace employes 10 to 15 per cent. is the only development in pig iron. What with cheap iron, coke contracts tending toward the dollar basis and labor at the lowest figure in seven years, there will be cheap pig metal made in the district tributary to the Lake Superior mines, but prices have already anticipated the reduction in large measure and there need be no expectation of a lower basis than $12.40 to $12.50 at furnace for Bessemer and $11.25 to $11.50, furnace, for mill iron.

Finished Material. Some agricultural concerns are inquiring as to prices of steel for the coming year, and expect to contract within the month. Several season orders for wagon iron have been placed in this market recently, and in the main figures went but little below last year's. The local mill situation is unchanged, except that the Cleveland Rolling Mill Co. started 250 men at work in their wire mill on Monday. Cleveland foundrymen have decided on a 10 per cent reduction in wages, which the men have agreed to accept. In structural material there has been no market, and the recent demand on bridge building account is wanting. In sheets there has possibly been more inquiry than for other mill products.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Another quiet week has passed, having little to tell of in the way of sales. One more iron concern—the East Chicago Iron & Steel Co.—has failed, but the failure is probably not a bad one, and is caused only by the lack of ready cash to meet current liabilities. The larger part of the business of the week was done in the country, trade in the city having been very quiet. Collections are in about the same shape as they were a week ago, neither better nor worse.

PIG IRON.—Only a small volume of business has been closed in the week. The outlook for the future is not any more encouraging than it was a week ago—probably no less. Sales of Southern irons have been a little larger than those of Northern irons, and country business is better than city business. Very little charcoal iron is being sold, and stocks of Lake Superior charcoal ore are now so low that a fairly large order would almost wipe them out.

BAR IRON.—Sales have been lighter in the past week, and there are no changes in prices to record. Quotations are nominally, 1.45c to 1.50c for bar iron; and 1.60c to 1.65c for bar steel, though concessions can be obtained from these figures on favorable orders.

RAILS AND TRACK SUPPLIES.—Business is very quiet, and prices are unchanged. Rails, $30 to $32; track bolts, 2.60c to 2.65c; spikes, 2c to 2.05c.

STRUCTURAL IRON.—The demand is still very light, and no sales of any size have been made. Prices are the same as last week. Beams, 1.85c to 2c; angles and plates, 1.80c to 1.90c; tees, 2.15c to 2.25c.

SHEETS.—The demand for black sheets continues light, with quotations unchanged at 2.80c to 2.85c, Chicago. Galvanized sheets have sold fairly well in small quantities. Prices are unchanged at 70 and 10 per cent. at the mill, and 70 and 5 per cent. from store.

PLATES, TUBES, ETC.—Only a small business is noted for the past week, with unchanged quotations. Tank steel, 1.80c to 1.90c; shell steel, 2c to 2.15c; flange steel, 2.25c to 2.35c; fire box steel, 3.75c to 4c; tubes, discount of 65 to 70 per cent.

MERCHANT STEEL.—Sales in the past week have been small, and the outlook for the future is not very encouraging. Open-hearth spring, 2.25c to 2.30c; machinery, 2.10c; to 2.25c; tire, 1.95c to 2.10c; crucible spring, 3.50c; machinery, 4.75c; tool steel, 6½c and upwards.

OLD RAILS AND WHEELS.—No business is being done and quotations are nominally the same as last week. Old rails $17; old wheels, $14; old steel rails, $11 to $14, according to length.

SCRAP.—The market is quiet, with little doing. No. 1 forge, $15; No. 1 mill, $11; turnings, $8; mixed steel, $9; coil steel, $13; leaf steel, $14; low tires, $13.

GENERAL MARKET RESUME.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The iron market continues at a standstill. Only a few mills are running and these have orders that will occupy their capacity for but a short time. There is starting and shutting down in one department and another, the aim being to make operations tally as closely as may be with current demand. The question of wages is agitating very few mill owners; the money problem is practically all there is of it. The banks are advising that mill operations be restricted all that is possible, because of their inability to get currency for pay-rolls. Prices are getting down to a point almost incredible; but low prices are no cure for the existing inactivity. Quotations on Bessemer pig and billets are only nominal; transactions have been made on the basis of $13.10 and $21, Pittsburg, respectively. Reports from Wheeling state that new business in blooms and billets is entirely a secondary consideration, unless it means prompt cash, and that work at the steel plants is being conducted on a smaller scale than for years.

St. Louis. There is no demand worth mentioning and most of the foundries are using very little, if any iron. This city is maintaining its reputation for stability in banking and manufacturing branches. Although the financial stringency is felt, yet all iron interests have withstood the pressure with one or two exceptions.

Cincinnati. There has been rather more inquiry for pig iron the past week than was to be expected under the circumstances. Some agricultural works and rolling mills have closed contracts for their minimum requirements for several months ahead, deeming this a favorable time to make purchases. The general temper of the trade, however, is uniformly against making any new engagements. The difficulty experienced in getting funds to meet pay rolls and current obligations, has resulted in many important works temporarily shutting down. This policy is encouraged by the bankers on the theory that a restricted demand for money will increase the supply and contribute to ease in rates. Temporarily, however, it throws thousands of men out of employment and emphasizes the hard times. In every department of the iron trade the policy of restriction is in full force. Furnaces are making concessions on bargain lots for immediate delivery and cash, but the buyers who are in position to take advantage of these opportunities are few.

Buffalo. There is no change in the conditions which have prevailed during the past few weeks. The movement of pig iron is at its minimum. Prices are steady but transactions are all small, buyers taking only what is required for immediate consumption, and quite a large porportion of the foundries are shut down. The prices quoted elsewhere are nominal.

Philadelphia The pig iron market remains in a depressed condition. The demand is very light. Mills that expected to start with a fair amount of orders on their books, have decided to remain idle indefinitely. Some that started last week are said to be curtailing their output. When things right themselves again, business is going to be done more on the cash basis. Firms who are weathering this storm ought to have no fear for the future.

Foreign Market. S. W. Royce & Co., of Manchester, Eng., make this comment on the iron market in Scotland and North of England at the close of July: "The pig iron markets at both Glasgow and Middlesbrough have been quiet throughout this month. No heavy amount of business has been passing, the holidays interfering with business at Glasgow, and shipments from Middlesbrough are not as large as might be expected. Still the tone has been good, and prices have slowly advanced until they are now about 9d. per ton higher than at the beginning of the month. This is largely due to the troubles in the coal trade, which are causing more inquiry for pig iron, though not to the extent that might be expected, and not much business is being arranged as sellers are naturally chary of giving quotations under present circumstances. The manufactured iron works in the midlands are fairly busy on old orders, and any new business now done is only for early delivery.

THE IRON TRADE REVIEW

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AUGUST 10, 1893.

THE BATTLE OF THE BANKS.

Bankers have learned a number of new things in the past few weeks. Heretofore it has been the rule that a bank which could not pay a depositor when he presented his check had only the alternative of closing its doors. Instances are cited in connection with the flurries of the past fortnight in which critical days have been tided over by the bank officials refusing either to pay or to close. In the case of one national bank, in an important inland manufacturing city, the paying teller flatly told several non-commercial depositors who wanted to draw out considerable sums, that they could not have the money; that if they insisted on getting it by legal process, they might succeed at the end of a six months' or twelve months' struggle in the courts, but if they left the bank alone and thus assisted it in passing the crisis they would undoubtedly get their money in from 30 to 60 days. In every such case the depositor, who meditated taking out his money to put it in a safe deposit box, saw the futility of pursuing a course that would tie up his funds in a receivership and bring hardship to the business firms of the place, besides precipitating trouble at other local banks. In some cases this policy of partial suspension of payments, and yet keeping doors open, was met with rather sharp comment upon the innovation, but the bank officials rightly opined that of two evils they were bound to choose the less.

In transactions between the banks of one city and those of another there has been a like introduction of unheard of methods. Payment of balances in cash has been refused where in ordinary times no bank would think of incurring the imputation on its credit that such a refusal would bring; and even the attempt to get currency by sending checks through express companies for collection is not attended with any better success. New York exchange has been at a discount in Chicago on account of this partial repudiation. Currency is the only thing that a receiving teller wants to see coming through his window and country checks are everywhere an object of suspicion. In not a few instances checks have been refused from a new depositer, if he had any expectation of checking against them in a way that would take any currency out of the receiving bank. It has been a grievance of the New York banks against their Chicago correspondents that the latter have sent bundles of checks on various Eastern country banks and then expected to draw cash from New York banks on the balances thus secured, while in many instances the New York banks could not get returns on these checks short of a week or ten days and then the country banks settled in exchange,

Currency, currency, currency is the banker's watch-word unceasingly. Anything that will take from him a dollar in currency is to be fought shy of; to increase his currency holdings or to keep them from lessening—that is the object of every move, the thought of every waking hour. And if this play of bank against bank is thus intense with only national currency in circulation, what would the situation be with State bank notes afloat in the way that some of our statesmen at Washington propose in their plans to relieve the money scarcity?

THE SITUATION AS TO SILVER.

Scratch a silver convention delegate and find an original greenbacker. Not in every instance, possibly; but in a majority of cases, certainly. "What do you silver men want?" inquired an intelligent young Chicago business man of an older man, wearing a silver convention badge, as the two rode in a street car the other day. "I don't know what the rest want," was the reply, "but I want more money." As the conversation progressed, the silver delegate unfolded his scheme, which turned out to be a very familiar one—the printing of money by the Government, in the way that was so frequently elucidated in the fiat campaign of 1878. "I want a law passed," continued the delegate, with much enthusiasm, "so that if I owed a million dollars, and the Government should take this old hat (lifting a broad-brimmed sombrero-looking affair from his head) and stamp on it, 'This is one million dollars,' I could take it to my creditor and say to him, 'Here's your money,' and if he didn't want to take that he could go to ——."

There is a "blood-to-the-bridles" abandon about this, that is not uncommon in the intense rhetoric of some of the free-silver contingent, and this is a feature of the campaign against gold—for that is what it amounts to—that will not attract reasonable and dispassionate men. It is a misfortune that the extra session of Congress was not convened before there was opportunity to organize and aggregate all the vehement and threatening elements that by mere lung power and strength of rhetoric are leading those in authority to believe that the repeal of the Sherman purchase act is opposed by any considerable or influential portion of the business community. What is the real aim of the free-silver men, as far as they were represented by the Chicago convention, is well pointed out by our contemporary, the *Engineering and Mining Journal*:

> This was not in the least a bimetallic convention, nor is the "league" intended or calculated to promote the cause of bimetallism. It is far more one-sided than any so-called "gold bug" meeting in the East or in London. Every "gold bug" counts on a large use of silver or subsidiary coin, but these "silver bugs" are unanimous in advocating a policy that would drive gold out of the country (at which many of them openly rejoice) and leave us silver alone.
>
> At the bottom, what they want is "cheap money and plenty of it," and the only reason they now advocate silver, where they formerly preached the "fiat money" or "rag baby," is that the old craze is dead beyond resurrection, and silver is still a live question. These men are the worst enemies of silver and of true bimetallism, and though very loud talkers and ready to "ride through blood to the bridles" in pursuit of their "will 'o the wisp," they will be blotted out just as they were when they tried to persuade the overwhelming majority of our people that the country would be ruined unless we had "unlimited paper money."
>
> It is an absolute waste of time and good printing ink to argue with people who deliberately state things they know

are false. If these men favored *true* bimetallism, which is not only the one thing which can now help silver, but which we believe also is absolutely necessary to prevent the disastrous consequences which would follow the appreciation of gold, they would ask for it, and not for free coinage, which means—as they well know—a mono-silver standard, and the total disappearance of gold from circulation. When we have examples of a free coinage country before our eyes there is no need of argument as to what free coinage means. Why don't they refer to Mexico or India as what they want? We do not object to people advocating free coinage if they want it and believe in it, but we do object to the wolves masquerading as shepherd dogs.

The immediate and unconditional repeal of the silver purchasing clause of the Sherman act is what the business world has been calling for, as the one thing that will go far toward bringing back confidence. What should take the place of the silver purchase plan is not pressing for decision; the long debate which that question is sure to bring on can well be put over to the ordinary session. It is to be hoped there will be wisdom enough at Washington to see the situation as the best business sense of the country sees it.

A FINANCIAL FAILURE.

There is no question as to the outcome of World's Fair finances; it is plain, even from the confused and contradictory statements given out by the directory, that financially the great exposition is a failure. The announcement was made the other day that a payment of something like $440,000 was to be made within a week on the bonds of the corporation; but it seems plain that any such payment will be at the expense of those whose claims are classified under the head of "floating indebtedness." The committee to investigate the Fair's finances made a report to the directory last week, which, while it does not say that the exposition will be unable to pay its bonded indebtedness, submits some figures and then significantly comments: "The directors can form their own conclusions from these figures, whether we can pay our bonds under the present system of management and whether or not radical reform is urgently needed."

The figures show that there were obligations under contract on July 1, of $1,286,675.26 and $84,739.90 added in July. On these $536,265.53 has been paid. There were in addition, accounts payable of $529,542.36, besides an appropriation of $100,000 for live stock sheds and $150,000 for live stock premiums. Besides this there were at the end of July, in round figures, $100,000 in bills not vouchered, and a half month's pay roll of $210,000 due—making the total $1,934,691.99. Deducting assets of $700,000 leaves floating debt of $1,334,691.99 Aug. 1, or $50,000 more than on July 1. The committee add:

> The financial situation of the corporation to-day, as estimated by the auditor, shows conclusively that the present system of financial management is all wrong and must be radically changed or we will be held responsible, and properly so, for the maladministration of trust funds. * * * The result obtained under the present system is leading this corporation into insolvency. The financial management of the corporation up to date can only be characterized as shamefully extravagant.

The actual receipts as they have come in day by day have made sad havoc of the calculations we were wont to see last year, which figured out a paying investment for stockholders. It is useless to point out how the result might have been otherwise. The Columbian Exposition is a unique prodigy; it will always be unique among expositions in every particular save in the financial outcome. And while that will not be different in kind from the results of other great fairs, it will yet be unique in showing the most magnificent deficiency in the history of expositions. It is certainly the part of wisdom to begin retrenching; to lop of extravagances in the employes' list, regardless of the official pride that may be wounded, or the official prerogative that may be trampled upon.

GERMAN ECONOMIES IN IRON-MAKING.

The promise of lower prices on iron and steel products, due to the lowering of duties, makes timely the consideration of further economies in iron and steel manufacture in the United States. Nowhere in the world have fuel economies in blast furnace practice, or the economies of prodigious outputs from the best equipped stacks, had better demonstration than in this country. Yet the economies that may be practiced one step farther back, namely, in connection with the producion of coke, have not been put in practice by home producers, though frequently pointed out in the discussions of technical societies and emphasized by the technical press. Consul General Frank H. Mason, writing from Frankfort, Germany, calls attention anew to the saving of by-products of coke, in a report on "German Economy in Iron Manufacture" just issued by the State Department. He notes at the outset the apprehension with which British iron masters have viewed the rapid growth of iron and steel production and export by Germany. While English exports of railway iron and steel fell from 1,000,000 tons annually, a few years ago, to 703,370 tons in 1891, and 467,986 tons in 1892, German exports of the same line of products, scarcely a factor in 1880, rose to 198,421 tons in 1890, and 233,943 tons in 1891, with a total export of pig iron and finished iron and steel amounting to a yearly average of 1,050,000 tons. From a production of 886,000 tons of iron and 125,000 tons of steel in 1870, Germany's output of finished iron and steel totaled 3,638,600 tons in 1891, and 3,878,000 tons in 1892. In the twelve years included between 1880 and 1892, English iron and steel production increased 70 per cent.; that of Germany 400 per cent. To two facts, in Consul Mason's mind, the rapidly growing importance of Germany in this field is due:

1. The introduction of the basic process, which enables the iron and steel makers of Westphalia, Silesia, and the Saarbruck district to use their cheap and abundant native ores.

2. The unrivaled chemical skill of the Germans, whereby they have succeeded in saving the by-products of coke manufacture, thus deriving a revenue from processes which in other countries entail a waste of material and financial loss.

There is nothing especially distinctive in the German application of the basic process, English steel makers using it to a considerable extent, while the economies in connection with its by-product have been well studied and applied in the United States; but Consul Mason's statement concerning German coke-making economies is worthy of some heed. Not to go into the detail of his report, his aim is to show how far in advance of other countries Germany is in appliances for saving the subsidiary products of coke-making—ammonia, tar and tar oils, with their valuable elements benzole, anthracene, etc. Otto-Hoffman coke ovens are the ones with which the best results have been attained. These are built in groups of 60. Aside from the saving of subsidiary products, these ovens are notable for the large amount of gas which they make available for making steam, lighting and other purposes, in addition to their own heating. The saving in fuel in working 60 of these ovens—counting

3,200 cubic feet of this surplus coke gas to be equivalent for heating purposes, to 193.5 pounds of coal—amounts to 7,560 tons a year in the Ruhr and Saar districts, and 9,450 tons in Silesia. Add to this the saving of sulphate of ammonia, worth $5.23 per 220 pounds, and tar worth 95 cents per 220 pounds, and the profits from the system reach a large aggregate.

The consul states that the revenue actually derived from the tar and ammonia produced by one year's working of 60 ovens in Westphalia, costing $166,000 apart from the condensing apparatus, was $40,200, or about 25 per cent on the capital invested. It is calculated that about 3,000 coke ovens in Germany are thus saving by-products.

Another economy very little practiced in the United States, because of the cheapness of coal, is credited by Consul Mason with its share in the cheapening of German iron and steel, and that is the molding of coal dust mixed with pitch into briquettes, which are used in place of steam coal.

He repeats what has been said frequently, that Europeans stand aghast at the recklesness with which the natural resources of the United States are wasted in the various processes of manufacture. The lavish abundance of materials dug from the ground has made any serious thought on this subject unnecessary thus far, and what has been written upon it has been merely noted as something worth thinking about in the dim future, when nature grows less prodigal. The era of cheapness now on and the day of greater cheapness that may be just ahead may show our iron and steel masters that the time for utilizing some of these new economies has fully come.

AMONG THE IRON MINES.

Vermilion Range:—

The week ending Aug. 3 showed 53,852 tons of ore shipped from Two Harbors—44,622 tons of Chandler and Minnesota, 3,633 tons of Franklin and 5,597 tons of Canton. The total shipments up to that date were 520,152 tons—217,795 tons of Minnesota grades, 258,245 tons of Chandler, 2,011 tons of Zenith, 9,917 tons Cincinnati silicon, 9,338 tons of Franklin and 1,213 tons of Hale. In the month of July there were 105 iron ore clearances from Two Harbors and the total shipment was 208,616 tons, the Vermilion range contributing 188,334 tons and the Mesabi, 20,282.

Gogebic Range:—

It is reported that the working force at the Norrie now consists of 140 men underground and 100 men on surface. One shift is being worked at No. 7 shaft and one at No. 3.

Shipments from Ashland for the week ending July 29 were 24,053 tons by the Wisconsin Central and 32,213 tons by the Lake Shore. For the season the shipments to that date were 653,023 tons.

Mesabi Range:—

The mayor of Biwabik sent word to Pres. Greatsinger, of the Duluth & Iron Range last week asking him to furnish transportation for 200 miners to Duluth. They were out of work and out of means and had no place to stay. The Duluth mayor sent word through Pres. Greatsinger that 2,000 idle men were in the streets of Duluth and it was becoming a problem how to feed them.

The first shipment of ore from the new dock of the Duluth, Mesabi & Northern Railway Co., at Duluth was made last week, Tuesday. The propeller Hiram W. Sibley and consort, Twin Sister, cleared for Fairport with ore from the Mountain Iron mine. Four ore trains daily are scheduled by the Duluth, Mesabi & Northern.

Last week a big find of ore was made on the Rouchleau-Ray property just west of the Minnewas mine in 58-17. The drill struck the ore at a depth of about 130 feet and went down through 101 feet of ore. Here the hole commenced to cave and rather than go to the expense of putting in a stand pipe this hole was discontinued and a new one started. The Irondale Land Co. has been organized for the purpose of developing this property.—[Mesabi Range.

The Biwabik and Hale mines on the Mesabi suspended operations last week and about 300 men are out of work. Stripping is still in progress at the Biwabik under the contract taken by Drake & Stratton, but it is not known how long this work will continue. Some of the miners employed about Virginia went out on a strike for wages due.

Marquette Range:—

There has been trouble in the past week at the Buffalo mines. No money has as yet been paid, although the men have been assured that a payment will be made this week. At the Queen the unmarried men made a demonstration against the married men and prevented their working. The miners have been assured over and over again that no outside claim can possibly come between them and a lien on the company's stock-piles and equipment. Some of them are in straits for necessaries, and Manager Cole is said to have paid many employes out of his own pocket, to relieve their families.

The Lake Superior Iron Co. has found further reduction of its force necessary, 200 men employed at the hard ore mine having been dropped in the past week, leaving the hematite mine alone active, with upwards of 300 men. At the Lake Angeline a reduction to two-thirds force was proposed by the management early this week; but it was decided later to keep nearly 600 men at work at reduced wages, dropping only 50 at present.

Menominee Range:—

Beginning Aug. 10, a cut of 10 per cent. will be made in wages paid at the Pewabic. The mine now has 500 men on its pay-roll.

Mr. Angus Smith, representing the Aragon Mining Co., to whom the Aragon mine comes back from the Schlesingers, says that he will do nothing more with the property this season than is now being done.

The Florence has discharged 50 men and kept as many more at work, though not a ton of ore has been sold in several months. The discharged men received their pay to date. The Florence has over 180,000 tons on stock-pile, and is hoisting 175 tons a day.

The Pittsburg Mill Situation.

There has been an alternation of starting and shutting down by various Pittsburg mills the past week, but practically no change in the situation. At the Jones & Laughlins mills about 800 men had employment last week. This week 500 to 600 men have been at work. The puddling department closed indefinitely on Saturday and on Monday the steel mill, the billet mill and mills 1, 2, 4, 5, 6, 10 and 11 in the finishing department were active. The policy is simply to run as orders require. Mr. James M. Bailey, of Phillips, Nimick & Co., in an interview with some of his men said he would sign the Amalgamated scale if it were revised to suit him. He wants a proviso that if a bar of iron breaks at the rolls the puddler is to receive no pay; that the puddler is to have no pay for extra weight on a ball over 225 pounds; that puddlers make five heats; that if a man is not wanted in the mill he may be discharged without interference from the mill committee; that water boys be paid by puddlers. There are three applicants for every place in this mill. At Zug & Co.'s, 200 men were given work at the start up Monday, the firm having signed the scale. At McKeesport, the Monongahela furnace was banked for an indefinite time. It is reported that the Oliver Iron & Steel Co. have been negotiating with their men with a view to starting under a special scale, but this is denied, Mr. David B. Oliver stating that the company are not ready to start the mill. Besides Zug & Co., the scale signers of the week are the Lakeside Nail Co., at Hammond, Ind., and the Richmond Standard Spike Co., at Iron Gate, Va. The Amalgamated Association have given up the fight at the Spang-Chalfant Ætna mill, declaring the mill open and permitting members to work at the wages offered by the company.

THE East Chicago Iron & Steel Co., of Chicago, assigned on Monday. The liabilities are placed at $70,000, of which $26,000 is notes endorsed for the recently failed firm of Parkhurst & Wilkinson. The assets are considerably over $280,000.

ENGINEERING CONGRESS AT CHICAGO.

Monday, July 31.

The first meeting of the Associated Engineering Societies was held at the Art Palace, in Chicago, on Monday, July 31. Mr. C. C. Bouney gave the opening address of welcome, and then introduced Mr. O. Chanute, vice-chairman of the committee on organization. After speeches by Sir Benjamin Baker, of London; Baron Quinette de Rochemont, of Paris; O. O. Gleim, of Hamburg; Hugo Kœstler, of Austria; Alfred Uyberg, of Russia; Celso Capæci, of Italy, and the chairmen of the various divisions of the Congress, the delegates dispersed to take part in the proceedings of the several sections.

MINING AND METALLURGY.

Mining and metallurgy engineers held a joint session in the Hall of Washington for the discussion of the two topics of geology and education. Henry M. Howe, president of the American Institute of Mining Engineers, was the chairman of the meeting. Prof. S. B. Christy, of Berkeley, Cal., presented a paper on "Mining Schools." "Mining and Mineral Statistics" was the subject of a paper contributed by C. Le Neve Foster, D. Sc., F. R. S., Llanduduo, North Wales. S. F. Emmons, of Washington, read a paper on "The Geological Distribution of the Useful Metals in the United States." W. P. Blade contributed another geological paper, describing the "Mineral Deposits of Southwest Wisconsin," and "The Lead and Zinc Deposits of the Mississippi Valley" were described by W. P. Jenney, of Deadwood, S. D.

In the consideration of engineering education, there was a general discussion of the present state of collegiate engineering under the several heads of mining, electrical, mechanical, civil engineering, etc., and a paper contributed by William H. Burr, professor of engineering at Harvard College on "The Ideal Engineering Education" was read.

MECHANICAL ENGINEERING.

The meeting of the Congress of Mechanical Engineers, was devoted chiefly to the interchange of cards and greetings. Eckley B. Coxe, president of the American Society of Mechanical Engineers, who is the presiding officer of this section, made a brief address, but there were no papers or discussions.

Tuesday, August 1.

METALLURGY.

At Tuesday's meeting of the metallurgical engineers several papers of great technical interest were read. The first of these was presented by James Douglas, of New York, who gave "a summary of American improvements and inventions in ore crushing and concentrating." This paper was discussed freely by the members present. Then followed papers by Henry Lonis, of the Singapore Strait Settlement on "The Specific Gravity of Gold Contained in Gold-Silver Alloys;" by H. A. Kelley, of Butte, Mont., on "Improved Clay Pots;" and by T. A. Richards, of Denver, on the "Limitations of the Stamp Mill." The last paper of the session was by W. P. Blake, of Shullsburg, Wis., which had for its subject, "The Separation of Blende from Pyrites: a New Metallurgical Industry."

MECHANICAL ENGINEERING.

The meeting of the mechanical engineers was presided over by Eckley B. Coxe, and was attended by many prominent engineers. The standing committee on uniform methods of testing materials recommended an international conference on the subject, and a resolution providing for such a conference and requesting the government to send delegates to it was adopted. The report of the standing committee to recommend a standard method for testing the efficiency of locomotives was presented by William Forsyth, of Aurora, Ill., of the Chicago, Burlington & Quincy R. R. Papers were presented by W. F. M. Goss, of Perdue University; M. Mailer, A. Von Borries and A. Schneider. The division of mining engineering attended the meeting of the mechanical engineers.

Wednesday, August 2.

MECHANICAL ENGINEERING.

The meeting of the mechanical engineers discussed papers as follows: "The Working of Centrifugal Machinery," by Gust. Herrmann, professor Technical High School, Aix-la-Chapelle, Germany; "The Removal of Dust in Workshops," R. Kohfal; "The Taxameter, or Fare Indicator," by C. Pieper; "Apparatus for Metering Steam," by Franz Seiler; "Improvements in the Art of Cable Making," by Emil Guilleaume; "Measuring of Water and the Schinzel Wa'er Meter," by F. Lux; "The Interchangeable System of Manufacture," by W. F. Durfee.

MINING ENGINEERING.

The congress of mining engineers had for its general subject "Ventilation and Safety." Papers on sub-topics were presented by Prof. G. Chisneau, of Paris; Prof. Frank Clowes, of Nottingham, England, and D. Murgue, of Besseques, France. Papers presented on the previous days were also discussed.

METALLURGICAL ENGINEERING.

In the congress of metallurgical engineers, attention was given chiefly to the discussion of papers on the scheduling and treatment of steel. The papers presented were by F. Osmond, Paris; Prof. A. Martens, Berlin; Alexandre Poureel, Paris; Albert Sauveur, Chicago, and H. Howe, Boston.

Thursday, August 3.

METALLURGY.

Processes for the manufacture of steel was the general subject which formed the basis of the discussion in the metallurgical congress. Prof. Akermann, of Stockholm, described, in an interesting manner, the Bessemer process as conducted in Sweden. A valuable paper on the open-hearth process was read by H. H. Campbell, of Steelton, Pa. Both papers were followed by discussions.

MINING ENGINEERING.

The general subject for discussion in the meeting of mining engineers was "Miscellaneous Mining." W. H. Case, of Bertha, Va., described the Bertha zinc mines. A paper was contributed by O. Bilharz, of Berlin, on improvements in ore dressing. F. O. Blackwell, of Lynn, Mass., read a paper on electricity in mining which aroused a great deal of interest and was discussed freely.

ENGINEERING EDUCATION.

Great interest was manifested in the discussions brough before the congress of engineering education, Dwight Porter, of Boston, read a paper on the laboratory of hydraulics at the Massachusetts Institute of Technology; Charles G. Jameson spoke upon field equipment and field practice; Mansfield Merriman, of Bethlehem, Pa., read a paper on methods of training engineering students in technical literature; J. B. Johnson, of St. Louis, described methods of studying technical literature; and Chas. S. Denison, of Ann Harbor, presented a paper on drawing for engineering students.

MECHANICAL ENGINEERING.

Professor V. Develshauoer-Dery, of Liege, Belgium, presented the first paper, which was a contribution to the theory of the steam engine, proposing a practical formula for use in design of apparatus. Chas. T. Porter read a paper on the limitation of engine speed. Frank H. Ball presented a paper on compression as a factor in steam engine economy, and Professor James E. Denton contributed one on the performance of a new oil line pumping engine, with and without the use of steam jackets on the cylinder. A joint paper, prepared by William A. Pike, of Minneapolis, and T. W. Hugo, of Duluth, on the performance of steel railway power plants, led to an interesting discussion. Jas. H. Fitts, author of the paper entitled "An Evaporative Surface Condenser," was killed in a railway accident while on the way to the congress, and his paper was read by one of the delegates. George H. Barris presented a paper on a coal calorimeter, and the session closed with a paper by T. W. M. Draper, of New York, which described a form of ammonia motor for use in street railway service.

Friday, August 4.

MECHANICAL ENGINEERS.

Among the papers presented at the meeting of the mechanical engineers was one by Thos. H. Brigg, of Bradford, Eng., on "Haulage by Horses." Mr. Sorge, of Chicago, read the paper prepared by Prof. C. Linde, of Munich, on the "Refrigerating Machinery of To-day." "Wire Rod Rolling" was the subject of a paper by Fred H. Daniels, which was followed by a paper from Prof. R. H. Thurston, of Cornell, concerning "Technical Education in the United States." William L. Chase, of Worcester, Mass., presented a scheme for the general classification and index of engineers. The closing feature was an address by A. Hurt, of Delft, Holland, describing the drainage machinery of the Netherlands.

METALLURGY.

The great saving in fuel effected by modern methods of gas firing was developed in a paper read in the session of the

congress of metallurgy. The paper was prepared by C. A. Stetefelder. Alexander Sattman, of Donawitz, Austria, read a paper on new processes for the protection of pig and refined iron. One of the most valuable papers was an interesting review of American blast furnace practice, by E. C. Potter, of Chicago. Interesting papers on "Sulphur in Cast Iron," by W. J. Keep; on "Blowing Engines," by Julian Kennedy, and on "Advances in Pyrometry," by W. C. Roberts-Anston, were also read.

MINING ENGINEERING.

Eckley B. Coxe, of Drifton, Pa., opened the session of the mining engineering congress with a paper describing a furnace with automatic stoker travelling grate. H. Le Chatelier, of Paris, contributed a paper concerning tests of hydraulic cements, which was discussed by Prof. John Goodman, of Leeds, Eng., after which the meeting took up the discussion of the papers previously read.

Saturday, August 5.

All the delegates to the various sections of the Engineering Congress met in the Hall of Washington, at the Art Institute, to hear the reports of the separate divisions. The meeting was presided over by Mr. Octave Chanute.

William Metcalfe, of Pittsburg, president of the division of civil engineers, thus summarized the proceedings in that branch:

Sixty-three papers in all were presented. Of these, fifty were printed in advance, covering about twelve hundred pages. Of these papers, which treated on a great variety of subjects, Germany furnished 20, Mexico 6, Portugal 5, England 3, Holland, France, South America and Canada 2 each, Italy, Nova Scotia and Australia 1 each, and the United States 18. The interest shown in the papers is evidenced by the fact that 318 engineers registered, while the average attendance at each session was about 125. The discussions took a wide range. It is impossible to speak in detail of the large number of valuable contributions to our literature that were made, but it may be asserted generally that the results of our congress will be far-reaching and productive of great benefit to the profession of engineering all the world over.

Eckley B. Coxe, president of the congress of mechanical engineers, said that the interest shown in the papers and discussions in his department impressed him as being very far beyond what would ordinarily be expected at such a gathering. He continued: Engineering papers in these days are not simply suggestions of men with bright ideas and no experience. They are the results of experience given, in exact terms, showing the pounds of water evaporated per pound of coal, or the horsepower developed by a pound of steam, as the case may be. It seems to me that the construction of machines by actual guess has about passed away, and that no designer or constructor of machinery who hopes to place his machine in competition in any market can any longer neglect a thorough professional consideration of every question and every detail that comes into play in the use of such machinery. One of the most important reports we received in our congress was that of our committee on standard tests, and I believe that this congress will ever remain a notable gathering in the history of the profession, for the reason that we are inaugurating a system of international testing, so that work done in one country will not be repeated in another. This is an important subject, and the engineering world should give it close attention.

Dr. R. W. Raymond, secretary of the division of mining engineering, reported both for that and the kindred section of metallurgy. He said that printed papers, covering about 1,200 pages, had been placed before these divisions, and had been discussed with interest and useful results. Both theorists and practical men were represented in the sessions, and all the latest discoveries and improvements in mining had been given attention.

The congress on engineering education next reported, through its secretary, C. Frank Allen. Mr. Allen said the work of the division had been remarkably successful, both as to the attendance and the character of the papers presented. The value of the congress had been such, he added, that the delegates had organized it into a permanent society.

Speeches were then made by Prof. Unwin, of London; A. Flaimant, of France; Prof. Hartmann, of Germany; Prof. Reuleaux, of Paris; Nabor Soliana, of the Italian Navy; Profs. Vosnessmsky and Ryurski, of Russia; Prof. William Ritter, of Switzerland; Alfred Von der Stager, of Belgium; Signor Cappacci, of Italy, and T. Bergindal, of Sweden. Chairman Chanute then made a few brief remarks, and declared the Congress of Engineers closed.

VIEWS AND INTERVIEWS.

Capt. Alex. McDougall, of the American Steel Barge Co., West Superior, found in his recent trip East, a general impression that business would improve in the fall. Work began Monday at the barge works, but only on a moderate scale. By winter, Capt. McDougall expects as brisk a season as the works have ever seen. "The ore business is pretty fair at present. We are taking two boat loads a day from the Allouez ore docks, but I think that in about ten days the Mesabi will be able to send down ore to its new docks, when the shipments will increase. As to the Steel Company's plant, there can be no doubt that it will be reopened. When it is reorganized, I should like to see furnaces in connection with it, and structural beams manufactured, and rails also. The raw material is at our door, and we are nearer Chicago, which is the market, than Pittsburg."

* * *

In recording his impressions of the iron and steel exhibits at the World's Fair, Mr. E. C. Potter, of Chicago, accords with the view taken by Mr. J. S. Jeans, in his report to the British Iron Trade Association, namely, that the Swedish exhibit is the most creditable of all. Mr. Potter also calls attention to a particular in which "gumption" would have stood some of our home exhibitors in good stead:

"The impression left upon the observer after an examination of the Swedish iron and steel exhibit is that of painstaking care both in the exhibits themselves and in the conduct of their works, their processes and products. One experiences as much satisfaction in looking at iron and steel products of high quality and purity as in looking at a thoroughbred animal or an art work of the old masters. Each is the best of its kind, and in this regard the Swedish products of iron and steel still maintain their pre-eminence throughout the world. Comparing the Swedish processes with the American, we find our chief recommendation to be rapid and enormous production. If the American exhibitors would attach to their pig iron exhibits a card stating that 'this iron is turned out of our furnaces at the rate of 2,500 tons per week per furnace,' or to each exhibit of rails, 'these rails are made at the rate of 2,000 tons per day,' our exhibits might attract some attention. Or if the Americans had taken the pains to show drawings and models of their really wonderful furnaces, machinery and plants in general they would have played their strongest card and put themselves beyond all chance of competition from foreign works. But for the Americans to pit themselves against the Swedes and Germans with the kind of displays they make at the World's Fair and to submit themselves to the judgment of the world on that basis, is to confess this country as third rate in iron and steel manufacture. To use a very slang but very appropriate phrase, we are 'not in it.'"

* * *

Mr. L. E. Cochran, the well-known Mahoning Valley iron man, said the other day: "Everything is very quiet." I am just now cherishing the hope that when Congress meets, it will decide to run pig metal into currency."

* * *

"On the whole," says the *Railroad Gazette*, "we are unable to see where the *industrial* condition of the country is seriously at fault. The producers, the carriers and the merchants seem to us to have conducted their business with reasonable sanity of late. By a process of exclusion we are led to attribute our troubles to a financial condition not superinduced by the industrial condition. We are not doctors in finance, and we shall not attempt to prescribe for its present distemper; nor shall we prophesy the result of any treatment of it. It would seem that if health were restored in that department, we ought to be able to go on much as before. But we have seen how serious the results of a lack of confidence may be; and possibly it will be some time after we really get well of that ailment before we believe it and act on that belief. But it seems to us absurd to liken the condition of things now with that in 1873."

APPLIANCES FOR MINE VENTILATION.

BY RICHARD O. JONES.

The old method of ventilation by the use of furnaces, wherein an air current is caused by an up draft from fires placed at the bottom of the shaft, has been replaced by a comparatively new method, wherein the current is formed by a centrifugal ventilator, termed in trade parlance a "mine fan." This is simply a paddle wheel usually enclosed in a spiral casing and rotated at a speed consistent with required conditions. The current is taken in at the side of the casing, and is blown out through the chimney or stack. The casing is connected directly to the portion of the mine opening called the airway. Roughly, these ventilators may be divided into two classes—exhausters and blowers. In the first, the current is drawn from the mine, through the fan into the atmosphere; in the second, the current is drawn from the atmosphere and blown into the mine, the use of either class depending upon the condition, design and location of the airways in the mine.

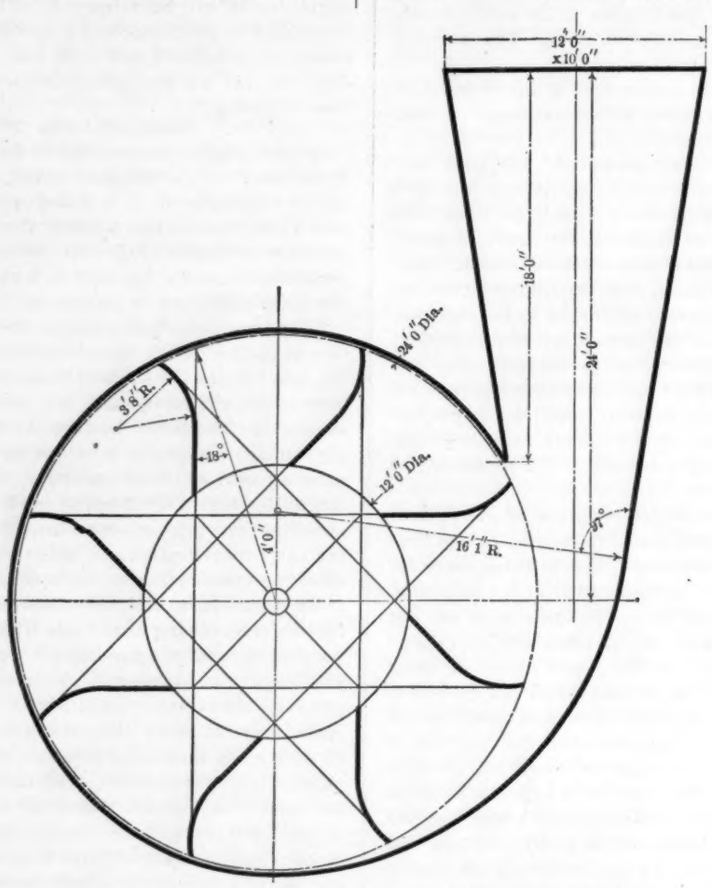


FIG. 1.—FAN AT LEHIGH AND WILKESBARRE COMPANY'S EMPIRE COLLIERY

The type of centrifugal ventilator in most common use is known as the "Guibal mine fan." This type has received the most exhaustive and careful tests, and it is to this that we shall give the most attention in the present article.

As to the design of the Guibal fan, much discussion has brought forward conflicting opinions as to the proper method of construction of the casing. All concede that the casing should be of spiral form; but at just what point the spiral should leave the periphery line of the paddles and the clearance begin, has hitherto been a matter of doubt. In illustration of this, we refer to Fig. 1, the standard design of the Lehigh & Wilkes-Barre Coal Co., in which the clearance, or space between the casing and the periphery line of the paddles, begins at the lower point where the vertical center line crosses the paddle circle. In Fig. 2, the standard design of the Susquehanna Coal Co., the clearance begins at or about the point of cut-off, or where the horizontal center line crosses the paddle circle next to the chimney or stack. In certain tests for efficiency, which will be referred to again, the design shown in Figure 2 would seem to give the most efficient results.

The design of the blades or paddles has also received much attention, some forms showing the paddles curved forward, some backward and some without curve, with reference to the direction of rotation. The fan is designated by the diameter of the periphery circle of the blades: thus, a thirty-foot fan is one in which the paddle circle is thirty feet in diameter.

The influence of the shape of the blades upon the volume of the current appears to be practically nothing; but a normal backward curve has a tendency to reduce the vibration or "beat" at the cut-off. This beat is still further reduced by the use of the "Walker shutter" placed in the position shown on Figure 1.

The Walker shutter is simply a sheet iron "V" which reduces the cut-off gradually, from the full width of the casing down to nothing at the extreme cut-off line. Adjustable shutters, hung on rollers and balanced with weights, are often used to vary the amount of the current, the shutter being raised to increase the outlet of the fan as the conditions require. The adjustable shutter is also used in connection with a movable partition, to change an exhaust fan into a blower. In testing these ventilators for efficiency, all results are calculated from readings of the anemometer, taken in the airways, from the readings of the water-gauge, together with indicator cards from the motive power.

From these data, obtained by careful tests, the following rules have been deduced:

1st. The volume of air produced by any centrifugal ventilator varies directly as the speed of rotation.

2nd. The depression produced varies as the square of the speed of rotation.

3rd. The theoretical depression of any centrifugal ventilator is double that depression due to its tangential speed.

4th. Efficiency varies as to the condition and design of airways in the mine.

5th. "Guibal fans" of large size seem to give greatest efficiency at a periphery speed of paddles of about one mile per minute.

Practical experience seems to show that the best proportions for fan design are as follows:

1st. Air inlet, one-half diameter of fan.

2nd. Width of casing, one-third diameter of fan.

3rd. Chimney or stack to be in height from cut-off to outlet equal to diameter of fan.

4th. Width of chimney or stack at horizontal center line

about one-fourth diameter of fan; at outlet, width equal to two-thirds diameter of fan.

5th. Clearance between blades and casing to begin at cut-off. Spiral of casing to increase into stack in arithmetical progression. Thus, for a twenty-five foot fan, clearance at upper vertical center line would be about 15″. Continuing around casing on direction of rotation, clearance at horizontal center line, 42″; at lower vertical center line, 70″; at cut-off, about 9′-0″.

6th. Blades to curve backward at outer end. Radius of curve, say, 18 inches on 25 foot fan.

As to volume of air current produced, a 35 foot fan driven at 55 revolutions per minute will throw about 235,000 cubic feet of air per minute.

We are indebted to Mr. R. Van A. Norris, M. E., of Wilkesbarre, Pa., for the accompanying illustrations.

CLEVELAND, O., August 7, 1893.

ON THE EDITORIAL TABLE.

"A Foot of Facts about Cleveland," is the catchy title of a twelve-inch strip of paper, three inches wide, and folded twice, just put out in an edition of many thousands by the Cleveland Chamber of Commerce. The "Facts" are pithily put, are strongly and suggestively grouped, and tell in about three minutes' reading what are the prime points of Cleveland's commercial and industrial eminence.

The mid-summer holiday number of the *Century Magazine* has, in addition to articles on yachting and camping out, a number of papers relating to foreign travel and art. Noteworthy among the record of travel are "Phillips Brooks's Letters to Children," accompanied by notes of his life, by one of his family. There is rather more than the usual amount of fiction, always abundant and excellent.

J. A. Fay & Egan Co., Cincinnati, O., have issued a catalogue of wood-workers, variety and universal. In addition to fine engravings of various machines, engravings showing the manner of performing a variety of operations with these machines, position of the hands, etc., are given. This catalogue is intended for general distribution, and will be found interesting to those in any way connected with fashioning wood by the aid of machinery. Copies will be sent on application.

The latest catalogue of the National Machinery Co., of Tiffin, O., directs attention with half tones and attractive letter press to the specialties of the company—bolt, nut, forging, upsetting, bending, spike, wire nail and rock and ore crushing machinery. With increased capital and an enlargement of its works, the company has much better facilities than ever, and is extending its trade in all directions. The rock and ore crusher, manufactured under the Lowry patents, has already been illustrated in these columns.

The Brainard Milling Machine Co., of Hyde Park, Mass.; Hill, Clarke & Co., Boston and Chicago, selling agents, have just published a new descriptive catalogue of their milling machines, reprinted from the new general catalogue of Hill, Clarke & Co. In this catalogue it is designed to show what the company is producing in the way of machines for milling, but many machines they have made for special work are not described. Among the machines illustrated in the catalogue are the following: upright plain milling machines; standard universal milling machines; milling machines with universal feeds; tool-room universal milling machines; Brainard's new gear cutting device; Brainard's new patent universal head; Brainard's new combination head and patent bank centre; centers for milling machines; cam-cutting attachment; spiral cutting attachments; rack cutting attachment; milling machine vises; mills and milling cutters, etc. The catalogue is very well gotten up, and is an excellent resume of the fine tools made by the company, who have the ambition and ability to procure as perfect machines as it is possible to construct, both in material and workmanship.

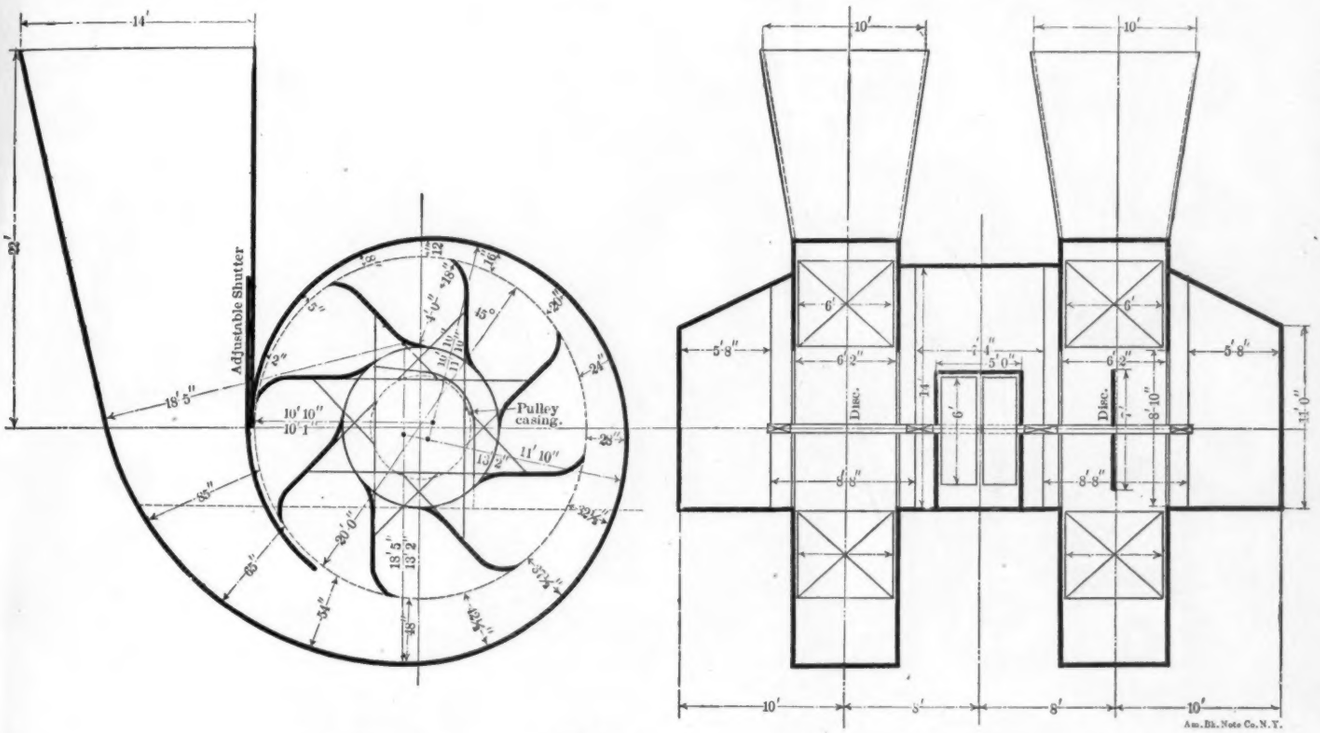


FIG. 1.—DOUBLE FAN OF THE SUSQUEHANNA COAL COMPANY, AT NANTICOKE, PA.

Hill, Clarke & Co., selling agents for machine tools, 156 Oliver street, Boston, and 14 S. Canal street, Chicago, have just sent out a little catalogue of the machine tools on exhibition at the World's Fair in their space in the main aisle of Machinery Hall, Section 28, Column K, 38-40. It contains illustrations of all the tools exhibited and a short description of each one.

THE Goulds & Caldwell Co., manufacturers of steel windmills, steel towers, pumps, pipe fittings, brass goods, etc., at 22 and 24 N. Canal St., Chicago, confessed judgment last week in favor of the National Bank of America, $20,000; the Lunkenheimer Co., Cincinnati, $3,442.63; National Tube Works Co., $1,250; Western Tube Co., $7,300; Gould Manufacturing Co., $24,300. The plant of the company was placed in the hands of the sheriff.

THE Courtright Hydraulic Machinery Co., 331 Rookery, Chicago, filed a deed of assignment last week, preceded by a confession of judgment in favor of Emil Rudert for $19,040. The company have lately finished a large contract for the city of Chicago, and the trouble is caused by the failure of the city's engineer to accept the job. The contract was for the large pumps and engines at Bridgeport.

THE PITTSBURG GAS ENGINE.

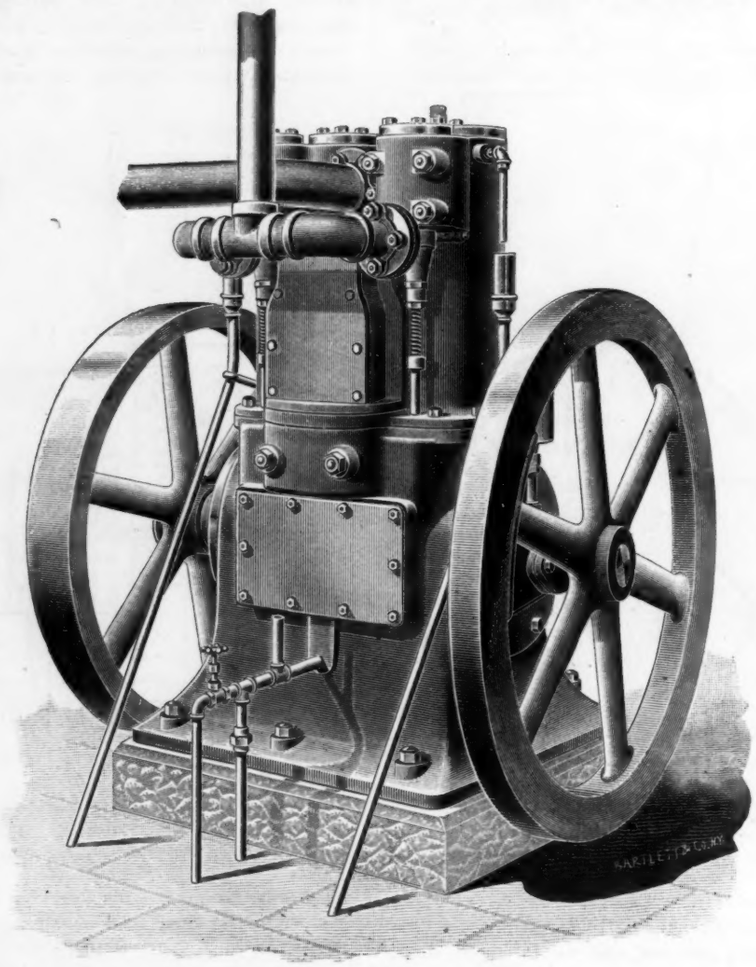
In designing the Pittsburg gas engine, the aim of Albert Schmid, superintendent of the Westinghouse Electric & Mfg. Co., and of Mr. Bechfeld, was to produce an engine possessing clear regulation under the widest variations of load; an admission device that would admit gas in quantities exactly proportioned to the power required; an ignition device that would be absolutely positive and efficient in its action; to provide complete jacketing and thorough lubrication; and to be compact and simple in its general design and to have all parts easily accessible.

The engine is made by the Fuel Gas & Mfg. Co., of Pittsburg, in sizes from ¼ up to 200 brake horse-power. Its most striking innovation is in the use of a crank chamber to inclose the bearings and lower end of the cylinders. This chamber is filled almost up to the shaft with a mixture of oil and water, into which the crank shaft and connecting rods splash at every revolution, so as to completely deluge the bearings, piston and interior of the cylinders, thereby not only affording copious self-lubrication, but also supplying an efficient jacket to the piston. Oil for the crank chamber is introduced through the main bearings, which are supplied from the only two oil cups on the entire engine. A simple pipe connection with a city main supplies the necessary water. Another pipe, serving so carry off the overflow, is made, by means of a funnel head, to indicate the level of the lubricants in the crank chamber.

All the Pittsburg gas engines are built with two cylinders on a single shaft, and, as usual, abnormal heating is obviated by the employment of water jackets. Each revolution made by the engine operates valves admitting the gaseous fuel alternately to the one or the other cylinder. As the period of admission is controlled by a positive action, the crank shaft receives an impulse once each revolution, no matter what the load, but the energy of that impulse is predetermined by an independent piston valve. In order that the maximum amount of energy may be developed by the explosion of the gaseous fuel, there is but one value that the relative amount of gas and air can bear to each other. This value has been determined by a prolonged series of chemical analyses, and the company now design their measuring piston valve so that it shall always admit gas and air in their correct proportion for producing the correct maximum result, but at the same time vary the total amount of mixture directly as the work of the individual piston stroke.

By reason of this nicety of adjustment of the energy developed to the momentary load, and by the constant use of fuel at its maximum efficiency, this engine is enabled to develop the maximum amount of work for each unit of gas used. Furthermore, as the shaft receives, once every revolution, an impulse that is proportioned to its load, a smooth and regular speed is maintained.

The governor regulates the speed and controls the admission of gas to the cylinders. It is mounted upon the shaft, between the cranks, and, by direct connection between the eccentric rod and valve stem, insures an accurate and positive travel to the measuring slide valve.



PITTSBURG GAS ENGINE.

The igniter employed is of the electric spark type. It consists, in brief, of an arm operated by a cam. At just the proper moment the arm is made to break an electric circuit, and the arc thus formed—intensified by the use of an induction coil—ignites the fuel instantly. As the arm is actuated by a positive motion, there can be no failure to produce a spark and no failure in the resulting ignition of the fuel. In order that the engine may be entirely self-contained, the electric current is supplied from a galvanic cell. If preferred, however, the requisite energy may be taken from a dynamo circuit.

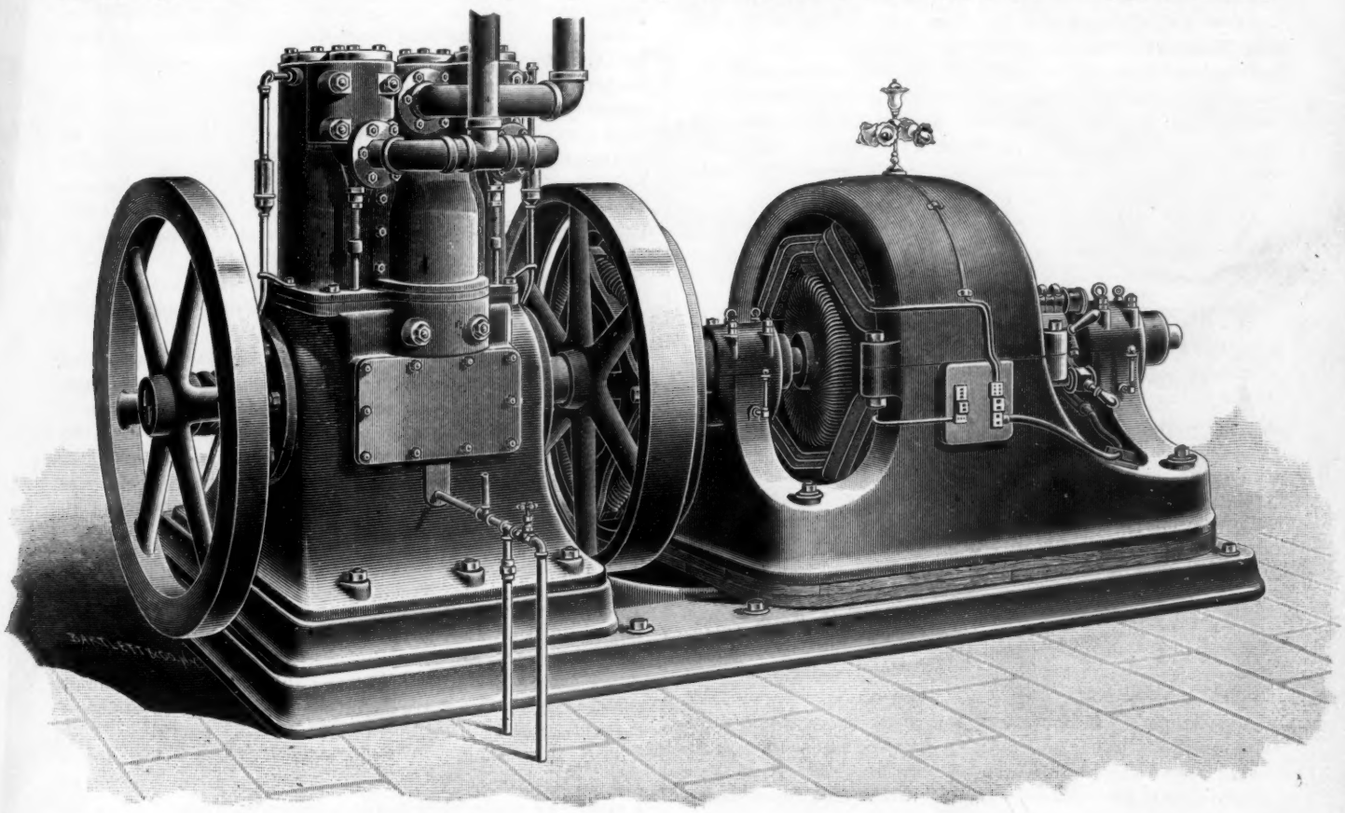
The following is the report of a test made by competent and disinterested engineers of one of these engines, rated at 9 nominal brake horse-power, having an 11-inch stroke and pistons 6 inches in diameter. As will be noticed, contrary to the usual practice, the company rate their engines by the brake and not by the indicated horse-power—*i. e.*, by the energy obtainable at the band wheel, which is the only work of any engine available for the buyer.

The test was made using city illuminating gas as a fuel. This is more expensive than common fuel gas, which nowadays is quite generally supplied through city mains or may be economically manufactured even on a small scale; but the company perferred to fulfill all the most exacting conditions, in order that any individual might decide for himself whether or not their engine was available for his own special conditions.

The gas meter employed was a standard one, manufactured by the Fuel Gas & Mfg. Coompany, and guaranteed correct within 1 per cent. The springs for indicator work were carefully tested, and the results corrected for any small error. The indicators were placed directly upon the cylinder cases. For measuring the delivered horse-power a Prony brake was used, having a wheel 27⅝ inches in diameter, and an arm 29 1/16 inches in length. The indicated horse-power was calculated in the usual—*i. e.*, from the number of revolutions and effective pressure.

The duration of each of the three runs made, A, B and C, was two hours.

	A	B	C
Load	Full	⅔	0
Load on brake in pounds	75.8	52.6	0
Revolutions per minute	223 5	223	221



THE PITTSBURG GAS ENGINE COUPLED DIRECT TO DYNAMO.

PRESSURE IN POUNDS PER SQUARE INCH IN CYLINDERS.

	Cylinder.			
Mean initial	I	159	103	27.4
	II	161	104	28
Mean terminal	I	25	18.8	8.8
	II	25.3	19	9
Mean effective	I	61	47	17
	II	61 5	47.2	17.1
INDICATED HORSE-POWER.				
Cylinder I		5.38	3.59	0.80
Cylinder II		5.40	3.62	0.82
Total		10.78	7.21	1.62
Brake horse-power		9.10	5.80	
Horse-power loss in friction		1.68	1.41	
Mechanical efficiency		84%	80%	
GAS.				
Temperature, degrees, C		22	16	15
Pressure in inches		1.5	2	2
Amount in cubic feet, at 0° consumed per hour		165	121.8	50
Amount in cubic feet, at 0° consumed per hour per 1 horse-power		15.3	10.9	30.8
Amount in cubic feet, at 0° consumed per hour per B horse-power		13.2	21	
WATER JACKET.				
Pounds of water used per hour		1538	1210	1009
Rise in temperature, degrees, C		220.2	19	17.8

Samples of both the supply and the exhaust gases were sent to the Pittsburgh Testing Laboratory to be analyzed. From the results of the analysis reported by that firm, it was found that a cubic foot of the gas used in the test will, if completely burned, yield 434.3 B. T. units of heat. Though this is a very low value per cubic foot, it only indicates that the Pittsburgh gas is a much better illuminant than fuel, and does not in any sense favor the gas engine; on the contrary, it rather reduces the efficiency by the unavoidable heating of superfluous air.

With the conditions of the test as given, the energy received and expended per hour was divided as follows:

Total energy received in foot pounds	55,200,000	40,800,000	16,750,000
Total energy expended:			
Indicated work in foot pounds	21,280,000	14,360,000	3,200,000
Water Jacket in foot pounds	23,900,000	17,800,000	1,382,000
Exhaust, radiation, &c., in foot pounds	10,020,000	3,740,000	12,168,000
Efficiency for 1 h. p	39%	35%	19%
Efficiency for B h. p	33%	28%	.....

Wages Reduced at Valley Furnaces.

A meeting of the blast furnace companies of the Mahoning and Shenango valleys was held at Youngstown, Saturday, and it was decided that the necessities of the situation compelled a reduction of 10 to 15 per cent. in the wages of furnace employes. The scale as agreed upon is the same as the one adopted in 1886, and provides $1.35 a day to bottom fillers and helpers, $1.60 to keepers, $1.50 to top fillers, laborers $1.15 and other wages proportionately. "When the reduction of 1886 occurred," said J. G. Butler, Jr., "Bessemer pig iron sold for $18.50 per ton at the furnace and mill iron from $15.50 to $16' according to quality. In April, 1892, the price of Bessemer was $14.60 and mill iron averaged $12.60. With no market for its sale, Bessemer is now offered at $12.50 and mill iron $11.25 to $11.50 at the furnace."

THE Overman Carriage Co., whose office and depository are at No. 10 E. Fourth St., Cincinnati, report that business was remarkably good in the first six months of the year, output and sales considerably exceeding the record in the first half of 1892. In July, business became quieter, owing to financial conditions, and the working force was necessarily much reduced. With the reputation this company has always enjoyed there is no question that a general revival of business will bring such a demand as will permit of a fair year's round-up.

THE Chicago & St. Louis Electric Co., which is to build an elevated road from Chicago to St. Louis, is continuing work notwithstanding the financial stringency has stopped arrangements which were virtually completed for placing the bonds. The company, however, claims to have sufficient money on hand to pay its bills for two years.

MACHINE SHOP AND FOUNDRY.

WESTERN FOUNDRYMEN'S ASSOCIATION.

The next meeting of the Western Foundrymen's Association will take place on Wednesday, August 16, at 7:30 P. M. in Room 702-703 Temple Court Building, corner of Quincy and Dearborn streets, Chicago. The general subject will be the same as that of the last meeting, "The Chemist as a Factor in Foundry Practice." The discussion will hinge upon the paper presented at the last meeting by Mr. H. O. Chute, and in connection the advisability of securing a chemist for the Association who can be consulted by the members of the Association in their private business, and who can also make tests to be the public property of the Association, will be considered.

Other important business of the meeting will be the election of a President of the Association in place of Mr. C. A. Plamondon, whose resignation was accepted at a recent meeting. At the last meeting, the names of Mr. Geo. M. Sargent, of the Sargent Co., Chicago, and Mr. Chas. Allis, of the E. P. Allis Co., Milwaukee, were put in nomination for this office.

It is desired that all members of the Association shall be present, and to foundrymen who are not members a cordial invitation to be present and take part in the proceedings is extended. Kindly inform the Secretary as to who will represent your house at the meeting, as this will greatly facilitate his work.

B. M. GARDNER, Secretary.

Chicago, Aug. 7, 1893.

CRANES AND THEIR KIN.

Entire establishments are very often brought to a complete standstill on account of a crane being unable to lift a load which the crane itself is strong enough to hold up but which the hoisting gear is not powerful enough to raise or control. The purpose of this article is to poiut out some ways by which as long as the structure itself—the mast, the boom, and the rest of its framing—is strong enough as well as the building to which it is fixed, if it is so fastened, the lifting power of the gears may be increased.

Once in a while with hand cranes this is done by having, instead of the ordinarily-used spur and pinion, another pair having greater pitch ratio; thus if there is for "every-day" use a 36-inch spur served by an eight-inch pinion, making four and one-half to one, with a distance between centers of 22 inches, to have another pair with a ratio of seven to one, the spur having a pitch diameter of 38½ inches to the pinion's five and one-half inches. The four and one-half to one gears being removed, the seven to one can be keyed on in their place. These gears should have wider faces than those which do less work, as the strain on the teeth is greater.

Another way is to fasten to the end of a beam a ring or a stud to which the hook of the hoisting rope or chain may be attached after the rope or chain is passed through a single block having a hook to which the load may be made fast. The result of this will be that for every foot of chain that is hauled in by the windlass the load will be raised only six inches; so that the hoisting power of the crab will be about doubled. (It would be just doubled if it were not for the friction of the extra block.)

Of course neither of these methods will enable a crane to raise a weight greater than can be properly put on its frame or on the chain and gears. If there should be any doubt about the latter, the windlass may be made to do double work without putting an extra strain on the frame which bears it, or on the chain itself, by catching hold of one end of the load and raising it, using the other end as a fulcrum; raising as high as is convenient, blocking up at the raised end, catching hold of the other end and doing the same thing, and so on, alternately raising, blocking and shifting. This plan will answer better for long articles, such as very heavy girders or posts, or for long cylindrical boilers, than for short ones like marine engines.

This plan of increasing the hoisting power of a crane is sometimes desirable, not because the crane itself or its chain or gears may be weak, but because of lack of good hoisting power. In some parts of the country, or in some conditions of the labor market, there may be insufficient man power at the crane; but if the gear may be changed from four and one-half to one up to seven to one, one strong man can do as much work with it as two light ones; or two light men do as much as two strong ones.

Where there is no crane that may be made of sufficient power, or where the existing cranes will not reach, there should be some one about the place who has ingenuity enough to rig up a tackle out of a few ropes or chains, and blocks, attached to the overhead timbers of the building, if there are any available; and if there are not, by the use of spars or of long balks resting on the wall plates or in the upper window opening or set in a tripod on the ground. Such spars should be lashed together with a rigger's hitch or with some of the suitable rope fastenings which may be learned from Brainard's little book on "Knots, Splices, Bends, Hitches and Lashings." Care should be taken to have the spread of the timbers as great as possible in order to give sufficient room among them to manœuvre the piece to be lifted, although it must also be remembered that the more spread such tripod has, for a given length of leg, the less load it can carry—a fact which must be borne in mind in handling heavy weights with long light timbers the strength of which has never been proved. (All such timbers, if not perfectly square in cross section, should be so placed that the strain will come on them in the direction of their greatest width; thus a two by eight is sixteen times as strong edgewise as crosswise, to a load applied at right angles to its length; and while this same ratio does not apply to where it is used as the legs of a tripod, and gets strain partly endwise and partly crosswise, this fact should be borne in mind and taken advantage of).

All hoisting chains should be annealed from time to time. After they break and kill some one is the wrong time to anneal them; prevention is better.

The bearings of all blocks should be kept well lubricated with black lead either with or without tallow or other grease. Those which have hinged shells are better than those with solid blocks, because they will permit the rapid reeving through them of ropes or of chains having hooks on their ends, it being easier to open a snap block, lay the rope or chain in the groove and close and latch the shell, than to unbend the rope from the hook or detach the chain from it—especially in view of the swivel that there should be at the hook.

Hoisting rope should be chosen not only with reference to its strength and durability, but with a view to flexibility. It will be found well to smear all hoisting rope well with graphite (black lead) with a trifle of tallow; this will greatly increase the ease with which it reeves through the blocks and to some extent lessens its stiffness without impairing its strength.

All hoisting ropes and chains should be kept, when not in use, either extended in place all ready to be put into service on a moment's notice, or properly coiled up in parallel "fakes" of easy curve; then they will last longer and be more readily paid out or handled when the time comes that they are wanted.—[Robt. Grimshaw in "Dixie."

THE Forest of Dean Mines, situated near Highland Falls, N. Y., and owned and operated by the Forest of Dean Iron Ore Co., of Poughkeepsie, N. Y., have closed down for an indefinite period. One hundred miners are thrown out of work. These mines have been operated without interruption for the past hundred years, and were producers as far back as 1756. Their output since 1865 is 430,756 tons.

IT will be of interest to Americans to learn that Worthington pump engines will be used for the water supply of the city of Osaka, Japan. By the placing of this order there is literally a "girdle 'round the earth" of Worthington pumping engines, these machines having worked their way as far East as China, up to the time of the awarding of this last contract.

THE Magnolia Metal Co., which sells its metal all over the world, extends to its friends an invitation to visit its exhibit at the World's Fair. It can be found at Section No. 10, Column No. E-53. All who are interested in the running of machinery with the least amount of friction are welcome.

THE LUNKEN GATE VALVE.

In few lines has there been less genuine invention displayed than in valve making. The Lunkenheimer Co. of Cincinnati, O., recognizing long existent defects in valves on the market, will soon add to their popular specialties the "Lunken" gate valve, the invention of Mr. Edward H. Lunken, who has brought out all the specialties manufactured by this company. The inconveniences and imperfections which this latest improvement is designed to remedy are the necessity of renewing a valve completely in case the seat becomes cut or much worn, and the crooked and cramped passages of the ordinary valve, causing great loss through resistance. It is a departure from the usual pattern in being more simple, and possessing the advantage of being a straightway valve. An idea of its compactness may be gained from the statement that a one-inch valve, warranted to stand fully 150 pounds working pressure weighs but ¾ pound.

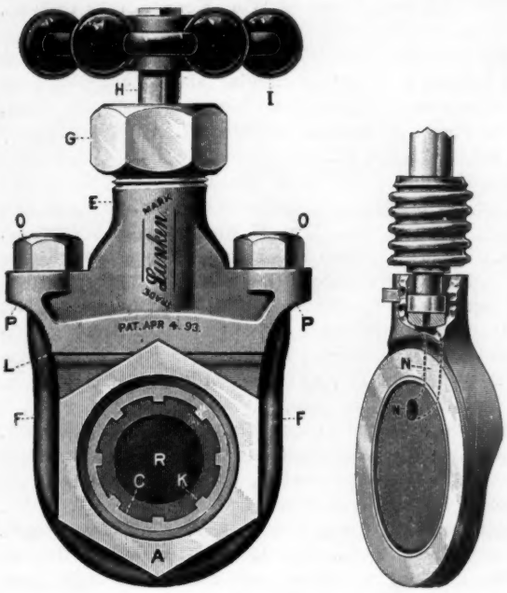


Plate A.
By-Pass Valve.

the washer. The valve can easily be taken apart without renewing the packing washer. The hub or bonnet is flat and narrow, and just of sufficient size to receive within it the valve disk when entirely raised, and has sectional or part-nut threads in its opposite interior sides. The theaded portion, J, of the stem by engaging with these part threads, causes the valve to be opened or closed. The disk has a straight flat face or bearing against the renewable seat C and is forced tightly against same by the self-adjusting wedging half-ring or horseshoe D secured loosely in the valve shell. The wedging on the disk is applied on two wedging surfaces, diametrically opposite each other, these coming in contact with the beveled ends of the half-ring or horseshoe wedge; thus the wedging is properly equalized on the entire disk and insures a tight joint on the opposite face. The pressure of the steam or liquid on the back or wedge side of disk also aids to make a tight closing valve.

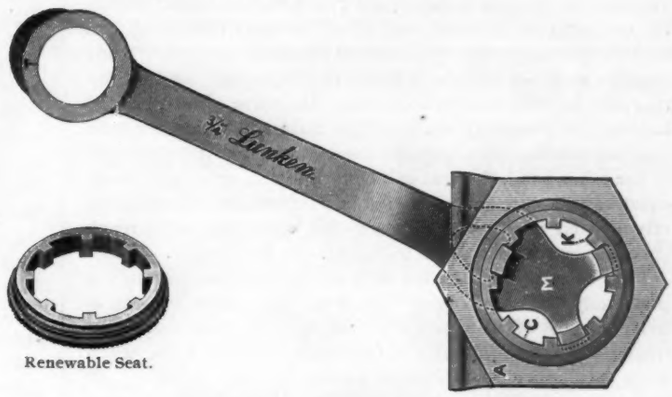


Plate B. Shell of Valve, Showing Application of Spanner End (M) of Wrench to Seat.

All valves above 2½″ size are provided with "by-pass," which arrangement balances the disk before opening same, and thus reduces the friction and wear on seat and disk to a minimum, and makes the valve open easily regardless of what heavy pressure may be on same. This automatic "by-pass" attachment is an all important improvement, and makes the "Lunken" gate valve the only really practical straightway steam and high pressure valve thus far constructed. The "by-pass" is shown in plate A and briefly explained, is an auxiliary valve formed in the top of the valve disk (immeditely below the yoke that secures same to the flanged head of the stem H) and is operated by the stem of valve, automatically, while opening or closing the main valve. Channel N, passing through the disk, connects the inlet or pressure side of the valve with the outlet side, and the end of the stem H controls this channel, there being sufficient play in the disk coupling to allow the complete opening of channel N caused

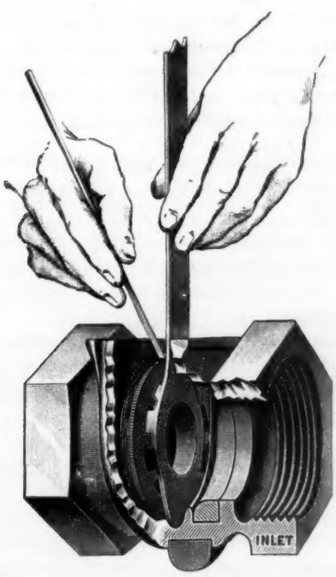


Plate D. Guiding and Screwing a New Seat into Shell.

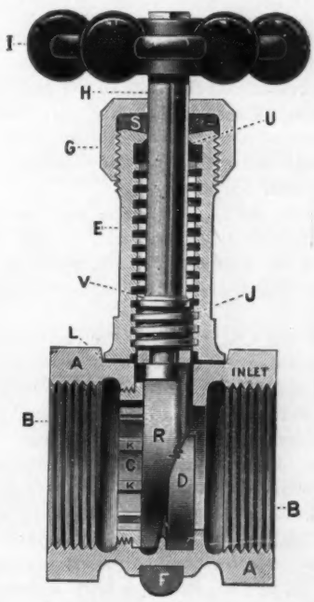


Plate E. Sectional.

The illustrations herewith show that the valve is unique in appearance and of a construction indicating special strength. The hub or bonnet is held to the shell by a coppered steel clip or strap surrounding the shell with its ends passing through the ears of the bonnet; and secured by nuts, O. This clip is held from lateral movement by projections on the shell. The joint is packed by a hard lead washer of $\frac{1}{64}$″ thickness, the top faces of flanges each having a groove, to properly secure

by the first ⅛ turn of the wheel in opening the valve. Plate E gives a sectional view of the main valve.

The renewable seat, as the cuts indicate, is an exteriorly threaded-flanged ring that screws against a face or shoulder of the flange, the opposite side of which flange forms the seat or bearing surface for the disk to close against. The inner periphery of the ring has lugs or teeth K for the engagement of the wrench M as seen in Plate B by which means, after taking off the bonnet E, the seat is operated, and either taken out or put in through the disk opening of the body, without disturbing the pipe connections. In iron body valves the renewable seat C screws into a second brass ring permanently fastened in the iron shell, otherwise, owing to the rusting qualities of iron, the renewable seat might rust tight in the shell. The ring end T of wrench is used to hold and guide the removable seat into place, so as to properly start its threads into the threads in the shell. Thus to renew the seat in the valve it is necessary to proceed as follows: Take off the bonnet, loosen the seat with the spanner end M of wrench; (engaging the lugs on interior periphery of seat as shown in plate B). Then unscrew and take out seat. Then place the new seat on the ring end T of the wrench and insert into valve, (see Plate D) holding the wrench in one hand, (to hold and guide the new seat into place), while with the use of a knife or pointed tool in the other hand, the seat (which is knurled or milled on its outer edge) is turned and started into its threads. When properly started and screwed down, the other end of wrench (spanner end M) is applied to tighten the seat firmly.

Thus in a few minutes and with perfect ease, any person can practically make a worn out "Lunken" gate valve as good as new; the cost of the renewable seat or a new disk being but trifling. Another important feature is that the stem, when valve is full open, seats itself (V against U) thus relieving all pressure on stuffing-box, and permitting repacking of same under pressure. The tie band surrounding the shell adds greatly to the strength of the entire valve, and permits of its being taken apart easily with a small wrench. The shell is so short and rigid, and the wedging surfaces are so small, that expansion and contraction do not affect it. Thus the disk will never wedge fast and become inoperative, which is the case with many styles of double-seated gate valves. Having but a single disk and the wedging half-ring taking the place of a second disk, as a wedging resistance, this construction overcomes the objection in double disk gate valves, where liquids remain in the shell between the disks and often freeze or injure the valve.

It is impossible for anything to lodge on the seat of this valve, because the disk and seat have a parallel straight face, and as the pressure on the back of the disk keeps it tightly pressed against its seat, it actually cuts away (like the action of the blades of a pair of shears) anything in its path. This feature, combined with the renewable seat, commends this valve for blow-off purposes.

As regards outside finish, the shape and construction are such that necessitate only the finishing of the stuffing box, the balance being left a smooth casting, while the steel band and nuts are drop-forged and nicely copper-plated to prevent rust.

The Lunkenheimer Co., realizing the importance and scope of this invention, are arranging, with the assistance of several other prominent manufacturing firms, to produce these valves on a large scale, so that they can be speedily and properly supplied to the trade generally, and at a price that will warrant general adoption. Propositions and investigations of manufacturers interested for American or foreign rights are solicited. The Lunkenheimer Co., after having experimented with and tested valves for the past six months on pressure exceeding 150 lbs., are now busily at work getting out valves in brass from ¼ in. to 3 in., and iron with screwed ends from 2 in. to 12 in., and expect in a few weeks to be ready to take orders. This company have a large exhibit at the Chicago World's Fair in Machinery Hall, section 25, column O-24, with a complete display of their specialties. Visitors can also see samples of the "Lunken" gate valve.

ALREADY the Erie canal has carried 20,000,000 bushels of grain out of Buffalo since the opening, or twice the amount to Aug 1, last year.

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trades:

Chicago, Ill.—The Universal Tack Co.; capital $25,000; to manufacture tacks under patents held by the company; incorporators: C. A. Stedman, Chas. L. Strong, A. L. Conkey, Wm. Kenny. Address letters care of Wm. Kenny, 11 McLean st., Cleveland, O.

Chicago, Ill.—The Electric Burglar Alarm Co.; capital $250,000; for mfg. and selling burglar alarms and electrical goods; incorporators: Jacob Lindheimer, Geo. D. Hoffman, Jacob S. Hoffman. Address letters care of L. A. McDonald, 807 Tacoma Bldg., Chicago, Ill.

Springfield, Ohio.—The Owen Machine Tool Co.; capital, $25,000; for the manufacture and sale of machine tools and machinery; incorporators: Wm. H. Blee, Wm. S. Wilson, W. H. Owen, Geo. Marx, Edward Harford. Address letters care of Oscar T. Martin, Springfield, O.

Bloomington, Ill.—The Thompson Co., of Bloomington, Ill.; capital, $5,000; to manufacture and sell mattress stuffing machines and other machinery; incorporators: R. R. Thompson, H. R. Dodge, L. H. McRoskey. Address letters care of Welty & Sterling, Bloomington, Ill.

Chagrin Falls, O.—The Dippo Mfg. Co.; capital, $50,000; for mfg. and dealing in metal castings and articles consisting in whole or in part of cast metals, etc.; incorporators: Geo. H. Dippo, W. F. Carr, C. H. Gale, H. O. Jones, F. A. Quail. Address letters care of Estep, Dickey, Carr & Goff, Cleveland, O.

N. Y. City, New York.—The Miller Electric Co.; capital, $5,000; for the manufacture and sale of electrical appliances; incorporators: Sylvanus E. Miller, Brooklyn, N. Y.; Samuel Shethar, New Castle, N. Y.; Edward A. Nichols, N. Y. City, N. Y. Address letters care of Samuel Shethar, New Castle, N. Y.

Newark, N. J.—Armature Bell Co. (incorporated in W. Va.); capital $1,000 min., $100,000 max.; for manufacturing and dealing in electrical bells, machinery, armatures and appurtenances connected therewith, etc.; incorporators: Lorenzo C. Carnana, E. Henry Brush, J. F. Reeve, Brooklyn, N. Y. Address letters care of Herman Kobbe, 49 Wall street, New York, N. Y.

New York, City, N. Y.—Standard Brake Co. (incorporated in W. Va.); capital, $500 min., $1,000,000 max.; for making, using and selling for use air brake apparatus and machinery, valves, pumps, etc.; incorporators: Geo. E. Madden, Plainfield, N. J.; Samuel O. Neuman, Brooklyn, N. Y.; Geo. H. Graham, East Orange, N. J. Address letters care of Geo. H. Graham, 115 Broadway, New York, N. Y.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

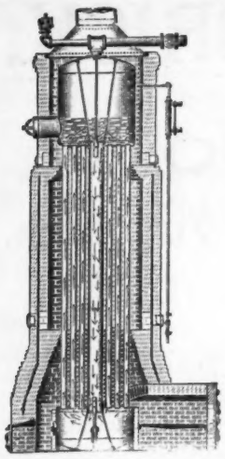
Bids on the heating and ventilating apparatus of the U. S. court house and post office building at Scranton, Pa., will be received at the Supervising Architect's office at Washington, D. C., until August 24.

The Buffalo Edge Tool Works, of Ridgway, Pa., recently incorporated, have buildings 50 x 30 and 40 x 90 feet. They will manufacture planing mill knives, meat cutting machine knives, ship tools, tinners' bench shears, paper-cutting machine knives, etc. Orders can be filled by Aug. 10. The new company will purchase emery wheels, lathes, machine shop supplies, planers, portable forges, punching and shearing presses, rolling machinery and coke.

The Supervising Architect, Washington, D. C., will receive sealed proposals until 2 P. M., Aug. 18, for all the labor and material required to furnish and fix in place complete a new low pressure, return circulation, steam heating apparatus, including power boiler and all pipe connections, furnishing of non-conducting covering material and applying same on all exposed steam and return pipes in basement, and also on the smoke breeching for the Butler Bldg., Washington, D. C.

Additions, Enlargements, Removals, Etc.:—

The Thomas-Roberts-Stevenson Co., of Philadelphia, stove manufacturers, have contracted for a one-story brick foundry,



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Cook Patent Water Tube Boiler.

THE ONLY PERFECT WASTE-HEAT BOILER.

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Repairs reduced to a minimum.
Can be used equally as well for direct firing or with natural gas.

WE ARE ALSO BUILDERS OF

HORIZONTAL, TUBULAR, AND FLUE BOILERS, LOCOMOTIVE, FIRE BOX AND ALL OTHER STYLES OF BOILERS, OIL TANKS AND WATER STAND PIPES.

Estimates furnished promptly on receipt of specifications.

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FIRE BRICK, FIRE CLAY,

For Blast Furnaces, Cupola Lining, Boiler Setting, Smoke Stack Lining, or Any Other Purpose.

EVERY CLASS OF SPECIAL SHAPES AND SIZES.

ALL KINDS OF

Foundry Supplies.

FACINGS, BLACKINGS AND MOULDING SANDS

Of All Kinds.

100x47 feet, and a three-story brick storage house, 33x66 feet, as an addition to their plant.

The Franklin Iron Co., of Franklin, Mass., will remove their foundry to Milford, where the following buildings will be erected: Main building, 102x47 feet, one story, with monitor roof; office and pattern shop, 60x25 feet, two stories; shipping and packing shop, 20x20 feet, two stories; core shop, 20x20 feet, one story; shed, 20x30 feet, one story.

As part of the addition the Cramps are building at their shipyards, an immense foundry is now under way. Arrangements have been made with the city of Philadelphia and the railroads for more land space, but the greatest addition will be that made possible by cutting away a large strip of Petty's Island, in the Delaware, opposite the yards. By piling and cribbing the Cramps will advance their shipways out into the stream, gaining the addional space necessary to build their large ships. On shore, the work of rebuilding the machine shop has been completed.

Fires and Accidents:—

The Kansas City branch house of the Whitman & Barnes Mfg. Co., of Akron, O., a five story brick building, was destroyed above the third floor by fire, August 3. Loss on the agricultural machinery in the building was $100,000; insurance, $70,000.

General Industrial Notes:—

At Latrobe, Pa., the Latrobe Steel Works reduced wages from 10 to 40 per cent.

At Indianapolis, the Eagle Machine Works have gone into the hands of a receiver.

The South Milwaukee Malleable Iron Works, recently burned, will be rebuilt.

Shœnberger & Co., Pittsburg, started two plate mills and the horseshoe mills on Monday.

The Cambria Iron Co.'s billet mill at Johnstown, idle for some time, resumed last week.

The Monongahela furnaces of the National Tube Works, McKeesport, have been banked.

The Milwaukee Tack & Nail Co.'s plant, at Layton Park, was closed on an execution for $14,611.

The steel mill of the Bethlehem Iron Co. resumed operations last week after a month's shut-down.

The Carrie Furnace Co., at Keating Station, Pa., dropped 60 metal carriers from its force last week.

The Allegheny Steel Co., of Pittsburgh, ask to amend their charter, changing their name to "A. M. Byers & Co."

The tin plate factory at Atlanta, Ind., south of Elwood, has gone into a receiver,s hands. It started six months ago.

The Wellman Iron & Steel Works, Thurlow, Pa., have posted notice of a 10 per cent. reduction in all wages and salaries. This will affect 790 hands. The open-hearth department is closed down and the Bessemer department is running half time.

The Detroit Foundry Equipment Co., Detroit, Mich., have opened a New York office at 182 Front street, in charge of J. Gilmour.

The Carnegie Mills at Beaver Falls will start Sept. 1, it is reported, and a large quantity of billets has been shipped into the yards.

F. W. Wheeler & Co., of Bay City, Mich., will close down their shipyard on the completion of the two steamers now under construction.

The J. P. Witherow Co., of New Castle, Pa., has bought in the Sheffield furnace plant at Sheffield, Ala., against which is held judgments of $86,000.

The La Belle Steel Works, in Allegheny, Pa., have been closed down indefinitely, except the 9, 10 and 14-inch mills. Out of 600 men, 500 are idle.

The Reading Iron Co. has started up its No. 5 tube mill, idle for a month. The mill will run double turn on orders that will keep it busy for some time.

At the foundry of Jones & Laughlins, a pulley, 24 feet in diameter with a face of 48 inches, was cast. It was cast in two pieces and weighed 54,000 pounds.

The 2,000 machinists and day laborers at the Edgar Thomson Works have been notified that hereafter only single time will be allowed for Saturday night and Sunday work.

Four sheet mills of the Ætna Standard Plant, at Bridgeport, O., started up this week to make up some stock to sort up warehouse stocks. The sheet trade is reported fairly active.

The Yale & Towne Mfg. Co., Stamford, Conn., give notice of a 10 per cent. reduction in wages and salaries. All the employes are retained but there will be some shortening of hours.

A 10 per cent. reduction in wages has been made in both the Youngstown, O., and the Middletown, Pa., plants of the American Tube & Iron Co., which went into a receiver's hands last week.

The Jackson & Woodin Mfg. Co., Berwick, Pa., have completed a new car wheel plant supplied with the Whiting system of cupolas by the Detroit Foundry equipment Co., Detroit, Mich.

Mills Nos. 1 and 2, at Jones & Laughlin's American Iron Works, Pittsburgh, resumed work last week, and other departments in which there was a suspension of operations, are again running.

Craig, Ridgway & Co., of Coatesville, Pa., have laid off a number of men and reduced the time of the rest to eight hours a day—the first time since 1873 that there has been any reduction of working force.

The Michigan Peninsular Car Co., Detroit, have cut down their force by 1,500 men at the two plants. The Peninsular plant has orders for cars that will keep it busy until Sept. 1, with about 1,200 men. After that date it is expected that both

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

GOVERNMENT ⁜ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

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THE WHITMAN & BARNES MFG. CO.,
Manufacturers of DIAMOND BRAND TWIST DRILLS.

FACTORIES AT
Akron, O.; Syracuse, N. Y.; Canton, O.; St. Catharines, Ont.
STORES AND WAREHOUSES AT
Boston, Mass.; New York, N. Y.; Philadelphia, Pa., Cincinnati, O.; Chicago, Ill.; Kansas City, Mo.; San Francisco, Cal.; London, Eng.; Paris, France.

works will shut down for a month or six weeks. There has been a reduction in wages of 10 to 15 cents a day.

Most of the Cambria Iron Co.'s mills at Johnstown, Pa., are shut down, and fully 3,000 men are idle. In addition, over 400 men are out of employment at the Gautier mills, while the rest are working one-third time.

The Bay City, Mich., Industrial Works, manufacturers of cranes, pile-driving machinery, electric transfers, dredges, etc., have closed down. There are a good many contracts ahead but railroads are not ready to close.

Huron Furnace, at Jackson, O., has gone out of blast and 250 men are thrown out of employment. Only three furnaces are now operating in Jackson county out of 22 stacks standing, half of which have been abandoned permanently.

The works of the E. & G. Brooke Iron Co., Birdsboro, Pa., idle since July 1, resumed July 31 with the full number of 400 employes in the nail, rolling and sheet mills. The company's two furnaces are operating and produce about 1,000 tons a week.

The P. H. & F. M. Roots Co., of Connersville, Ind., have brought suit against the Pennsylvania Coal Co. and the Dunmore Iron & Steel Co. to restrain the defendants from making, using or selling an apparatus for removing slack coal upon which the plaintiff claims a patent.

The new American Line steamers now building at Cramp's yard, Philadelphia, will be fitted throughout with Worthington pumps, manufactured by Henry R. Worthington, New York. The order for the pumps also covers Worthington feed water heaters, such as are now used on some of the fastest trans-Atlantic liners, among which are the "New York" and "Paris" of the American Line.

At the Warren mill of the Union Iron & Steel Co., of Youngstown, O., all the office force, mechanics and the millwright have been notified that their services are not needed for the present. On account of the condition of the iron market and the money market the management regarded the resumption of operations so indefinite that they did not care to keep any longer the employes retained at the time of the shut-down.

In contrast with the general tone of depression, the Carpenter Steel Co., of Reading, Pa., announce that by reason of new contracts they will put in operation 12 new crucible furnaces, Monday next, and give employment to new hands. Last week's wages, amounting to $6,000, were paid in gold. This company has just been awarded the contract to furnish the war department with 200 12-inch armor piercing shells, similar to those recently tested at Indian Head. Each shell will weigh 850 pounds.

Ten per cent. reductions in wages have been made by the Thomas Iron Co., at Hokendauqua, Pa.; the Dayton (Tenn.) Coal & Iron Co.; the Roane Iron Co., Rockwood, Tenn.; and at the blast furnace of the Jefferson Iron Co., Mingo Junction, O.; and from 10 to 20 per cent. by the Colebrook & Worth, Lebanon, Pa., furnaces. At the Worthington pump works, at Elizabeth, N. Y., the molders refused to accept a ten per cent. reduction and the works were ordered closed indefinitely. Three hundred men are idle. The agricultural and engine works of Russell & Co., at Massillon, O., will close for an indefinite period about Aug. 15.

A statement just filed in probate court by the assignee of the Variety Iron Works, Cleveland, in connection with a motion for extension of the time allotted for keeping the works in operation, shows that the company's liabilities have been reduced since the assignment in March, 1891, from $469,165.48 to $287,214.79. The assets at present are given as $242,808.38, as against $293,514.35 at the date of the assignment. The excess of liabilities over assets is now $44,406.41. Sales to the amount of $1,312,924.40 are reported, while the running expenses have been $1,261,501.47. The company now has contracts to the amount of $100,000 on hand.

To the Mountain and Ocean Resorts via Pennsylvania Lines.

The advantages peculiar to the Pennsylvania Lines make them the desirable thoroughfares to Bedford Springs, Altoona, Ebensburg, or any of the delightful summer havens in the cool Allegheny Mountains. By no other route can Cresson, the ideal retreat on the crest of that romantic mountain range be reached, as the Pennsylvania is the only line direct to it, and the only one leading past the Pack Saddle and the Allegrippus, around the famous Horse Shoe Curve and along the Blue Juniata, the richest of America's scenic gems. For reaching Atlantic City, Cape May, Ocean Grove, Asbury Park, Long Branch, Sea Girt, Elberon, Ocean Beach, Berkeley, Newport, Narragansett Pier, Martha's Vineyard, Nantucket or any of the numerous watering places that dot the Atlantic seaboard from the Carolinas to Maine, these lines are particularly desirable. For a trip to the Adirondacks, the Catskills and resorts in Northeastern New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire and Maine, exceptional facilities for a delightful journey are offered passengers via this direct route. For detailed information, please apply to your nearest Pennsylvania Line ticket agent, or address F. Van Dusen, Chief Assistant General Passenger Agent, Pittsburg, Pa.

To or From Chicago via the Lakes.

If going to Chicago and not pressed for time, take the greatest trip to the greatest fair on earth having a one-thousand-mile ride on the grandest palace steamers on the lakes, returning from Chicago all rail. If preferred, can go to Chicago all

rail and return via the lakes and Detroit. Berths and meals included between Mackinac and Chicago. This trip will give very pleasing, picturesque scenery, and a refreshing, restful change. A very enjoyable trip for all to take, and will well repay doing so. Round trip rate from Cincinnati $21 30, via Toledo and boat 30 cents less. For further information as to rates from other points ask any agent on the C. H. & D. system, or address E. O. McCormick, G. P. & T. A., C. H. & D.R. R., Cincinnati, O.

The Track-Laying Record for '92.

We would like very much to know exactly and authoritatively how many miles of track were laid in this country in 1892 Poor's *Manual* says 4,648.46, but we do not believe it. In its corrected statement in February last the *Railway Age* footed up 4,178 miles. The *Railroad Gazette* was able to find only 4,150 and the *Engineering News* was content with 4,070. The *Manual* does not venture to give detailed statement, but only gives the total number of miles of new road for each state, not even stating the number of lines, which would afford a means of checking. We are satisfied that it included figures for several roads which where currently reported completed, but on which considerable mileage was unfinished at the end of the year; for example the Rock Island's extension in Nebraska, 22 miles not completed and the M. K. & T. in Texas, 41 not completed. It also evidently added 45.7 miles built by the Southern Pacific in Arizona on a new route to replace 39.1 miles of track, by the old route, which was taken up, leaving a net increase of only 6.6 miles, instead of 45.7. Other probable errors might be named, so that we are prepared to repeat that the construction of 1892 did not exceed 4,200 miles. The *Manual* indeed in another table reports the actual increase of mileage for the year at 4,428, having deducted 219 miles for errors in the previous aggregate; so that the grand total of 175,223 miles of road in the United States at the end of 1892 can not be far out of the way.—[Railway Age.

Iron Rails Going, but Slowly.

STEEL rails continue to supplant those of iron, and yet iron rails have by no means disappeared, as they are still in use on 38,600 miles of track, or 17.4 per cent of the total track in the United States. The iron, however, is chiefly found on side

Worst Coke Slump on Record.

The coke trade last week continued its decent of the toboggan and came down with a rush. The decrease in the total weekly output was over 18,000 tons. The only explanation given by the operators for this big slump is that the furnaces are blowing out and every day orders are becoming scarcer. Ovens are being blown out to keep production down to the orders. Last week almost 2,000 active ovens were forced into idleness, and there are now about 1,000 more idle than active ovens in the region. The feature of the week was the suspending of W. J. Rainey's orders to Western points. Heretofore Rainey has been making the best time of any of the operators in the region. Some of his ovens will likely be blown out this week. The Grace plant at Moyer, is booked for a shutdown. The bottom fell out out of the big operators' orders last week, also, and caused them to shut down several plants. The indications are that this week's shipments will be the lowest since the strike. The blowing out of the furnaces at Sparrow's Point will seriously affect the Eastern shipments.

The *Courier's* detailed report of the operation and output of the region for the week ending, Saturday, July 29th, shows 8,310 ovens in blast and 9,023 idle, with a total estimated production of 69,332 tons. Compared with the production of the previous week this was a decrease of 18,774 tons. This is one of the biggest drops in the total weekly output that has ever occurred in the Connellsville region, barring strikes. Almost 2,000 ovens were blown out last week. The H. C. Frick Coke Co. blew out Leisenring Nos. 1 and 3, Youngstown and Foundry, comprising 706 ovens. At the other Frick works the following number of ovens were blown out: 96 at Redstone, 50 at Valley and 34 at Trotter. The Southwest Connellsville Coke Co. now have their 1,202 ovens idle, having blowed out the remaining 420 active ovens at Southwest No. 1. The McClure Coke Co. blew out 68 ovens at Donnelly, 100 ovens at Lemont No. 2, 50 ovens at Hazlett and 50 ovens at Mayfield. The Hecla Coke Co. put out 20 ovens at Hecla No. 1. At the Whitney plant of the Hostetter Connellsville Coke Co. 50 ovens were blown out.—[Connellsville Courier.

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And Calcining Apparatus

Dries Ores, Sand, Paint Stocks, Brick Clays, Salt, etc. - - - - - - - - -
Calcines Gypsum, Ores, Paint Materials, etc. - - - - - - - - -
The F. D. CUMMER & SON CO.,
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IRON & STEEL FOUNDERS
59TH & WALLACE STS. CHICAGO.
BRAKE SHOES-STEEL CASTINGS.

tracks. The steady change which has been going on is indicated by the following figures:

Year.	Miles steel rails.	Miles iron rails.	Total miles.	Per cent steel.
1880	33,680	81,967	115,647	29.1
1885	98,102	62,495	160,597	61.0
1890	167,606	40,697	208,303	80.4
1892	182,858	38,641	221,499	82.6

It is interesting to observe that the total mileage of track of all kinds in the United States, 221,499, is greater by 46,276 miles than the total mileage of lines, 175,223 at the end of 1892, accoding to Poor; in other words, that on the average, for every 100 miles of main line, single track, there are 26 miles of sidings and additional tracks—which is a good thing for the railmakers.—[Railway Age.

World's Fair and the West.

Go via Valley and B. & O. Railways. Trains leave Cleveland 10:30 A. M.; through day coaches; 6:30 P. M., fine Pullman sleepers. The only line running direct to the World's Fair grounds.

THE longest steel plates ever used in the construction of transatlantic tonnage are now being put in the new steamers building for the Chesapeake and Ohio Steamship Co., of London, by Furness, Withy & Co., of West Hartlepool, Eng. These plates are 60 feet in length by 4 feet to 4 feet 3 inches in breadth, thus making only one "butt" joint in a strake of 120 feet, 32 feet plates have been in ordinary use hitherto and these were handled with ease. Lloyd's surveyors are much pleased with the constructive work as shown in the long plate system.

Poor's Manual for 1893, just issued, gives the total railroad mileage of the United States up to December 31, 1892, as 175,223 miles, the net increase in the year 1892 having been 4,429 miles.

PHILADELPHIA CORUNDUM WHEELS,

Made by the Philadelphia Emery & Corundum Wheel Co.

These Wheels are absolutely superior in all things to any Emery Wheel made. They are guaranteed to be made entirely of pure sapphire North Carolina and Georgia Corundum. They are a very free, fast-cutting, open and porous, durable and lasting wheel. Will cut faster, do more work and last longer than any Emery Wheel made. Will not glaze or fill up, nor wear away too fast. Are uniform in temper, will wear even and true and not get out of balance. Will not heat tempered steel enough to draw the temper, case harden or burn it when run dry, and are one of the best wheels made for running in water. Are one of the strongest and safest wheels made, and not as liable to break as most other wheels are. Every wheel can be exactly duplicated at any time; they are sold on their merits, are sent on trial and approval, guaranteed to give entire satisfaction, and if they do not do so can be returned.

THE MADDOX COTTON AND WIRE BELTING,

Made of cable steel wire and cotton woven solidly to is absolutely the strongest, toughest, most powerful, flexible, durable and lasting belting made, without any exception whatever. It is stronger, tougher, more durable and will transmit more power than the best oak tanned double leather belting made. It will not stretch or slip even when wet. It is waterproof and is not effected any by water, steam, dampness, moisture, heat, dryness, oils grease, acids, chemicals, dust, changes of climate or weather. It will not rot, mildew, crack, or get hard or stiff. Does not require any grease or belt composition nor special care, but will always keep soft and flexible and in good condition for use. It is cheaper in price than single leather belting, and fifty to seventy-five per cent. cheaper than double leather belting. It is absolutely superior to all other kinds of belting for all other kinds of belting for all places where beltingof ans kind is used.

THE MINERALIZED RUBBER BELTING, HOSE, FIRE HOSE, SUCTION HOSE, Pure Gum Tubing and Packing, made by the **Mineralized Process**, are superior in many things, more durable and lasting than any goods of the kind made. No sulphur is used in the manufacture of them; they are not affected by water, steam, dampness, acids, chemicals, oils, grease, or other things, as much as other rubber goods are that are made with sulphur; they are guaranteed to be made of the very best pure Para Rubber, and not to contain any old rubber, shoddy, rubber compositions, or any other adulterations of any kinds; they will not rot, crack, peel off, or become stiff and hard.

THE PATENT FLUTED RUBBER BELTING will not slip on smooth pulleys under the heaviest strains and loads, and will often save its cost in a short time. The Belting and Hose is stronger, and will stand more hard use, and last longer than any other rubber goods made. The Fire Hose is warranted for three years' time and to stand a pressure up to 400 pounds to the square inch without bursting. It will not rot, crack, or mildew, and needs no drying out.

THE HUNTINGTON EMERY WHEEL DRESSER. This well known Tool for truing up, and dressing off Emery and Corundum Wheels, is now made on an extensive scale, by the Philadelphia Emery & Corundum Wheel Co., and is offered to the consumers and the trade, at a low price. This Tool is guaranteed to be the genuine Huntington Dresser, well known to nearly all users of Emery Wheels, and be strictly first class in material, quality and workmanship. Price $2.00 each, complete, with an extra set of Cutters. Extra Cutters, $3.00, per dozen **sets.** Will be sent, express charges prepaid, when the money is sent with the order.

TO WHOLESALE JOBBERS, DEALERS, and the Trade generally, they will be furnished in quantity lots, at a lower price than they can buy them for elsewhere, and they will find it to be greatly to their interest to send for prices before buying elsewhere.

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ROOFING AND SIDING OF MILLS, FACTORIES, ETC., A SPECIALTY,

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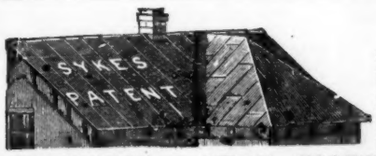

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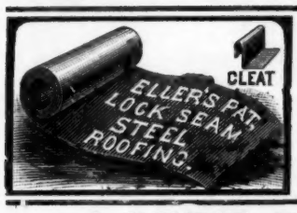

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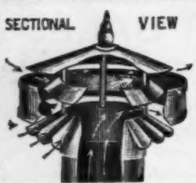

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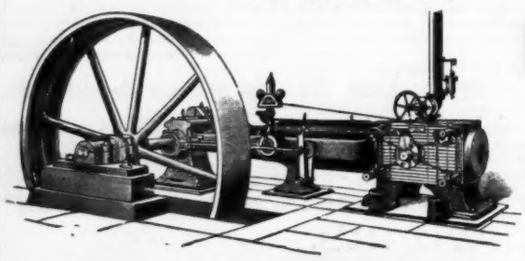

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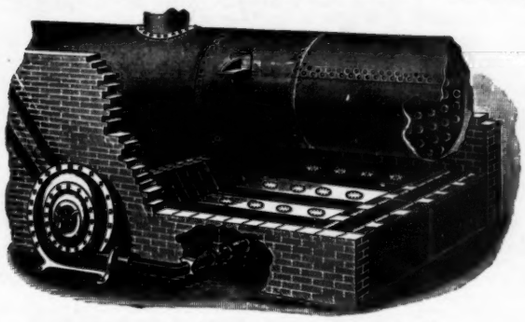

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Akron, Canton & Chicago	*8:00 A M	*6:30 P M
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Wooster	.....	*6:30 P M
Akron, Canton & Marietta	†2:25 P M	†11:15 A M
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Vulcan Iron Works Co., Toledo, O.
Richard O. Jones, Cuyahoga bldg., Cleveland, O.

Municipal Bonds—
Frank R. Biedler, Baltimore, Md.

Milling Machines—
Cincinnati Milling Machine Co., Cincinnati.
Godfrey J. Bremer, Kalamazoo, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Hill, Clarke & Co., Chicago, Ill.
Prentiss Tool & Supply Co., Chicago, Ill.
Callender & Patterson, Dayton, O.
Superior Machine Co., Cleveland, O.

Mines and Mining Stock—
Frank R. Biedler, Baltimore, Md.

Mining Engineers—
A. Leofred, Quebec, Can.
Richard A. Parker, Marquette, Mich.

Mechanical Engineers—
J. C. Slocum, Chicago, Ill.
Richard O. Jones, Cuyahoga bldg., Cleveland, O.

Office Furniture—
Cleveland Desk Co., Cleveland, O.

Oilers—
Rau Manufacturing Co., Chicago, Ill.

Oil Burners—
C. D. Juvinall & Co., Upper Sandusky, O.

Oil Tanks—
Aultman, Taylor Mfg. Co., Mansfield, O.

Ore Crushers—
Bradley Fertilizer Co., Boston, Mass.
Lake Shore Iron Works, Marquette, Mich.
Copeland & Bacon, New York City, N. Y.

Paint—
Iron Clad Paint Co., Cleveland.
W. W. Lawrence & Co., Pittsburg, Pa.
Jos. Dixon Crucible Co., Jersey City, N. J.
Empire Paint & Roofing Co., Philadelphia, Pa.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill.
Aitchison Perforated Metal Co., Chicago.
Chas. Mundt & Co., New York, N. Y.

Photo-Engravers—
National Photo-Engraving Co., Cleveland.

Powder—
Hercules Powder Co., Cleveland.

Power Plants—
Weston Engine Co., Painted Post, N. Y.

Presses—
Toledo Machine & Tool Co., Toledo, O.
Cleveland Stamping & Tool Co., Cleveland, O.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.

Plumbago—
The S. Obermayer Co., Cincinnati, O.

Pulleys—
Lane & Bodley Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.

Portable Forges—
B. F. Sturtevant Co., Boston, Mass.
Foos Mfg. Co., Springfield, O.

Pulverizing Machinery—
Bradley Fertilizer Co., Boston, Mass.
Lake Shore Iron Works, Marquette, Mich.

Pumps (Steam)—
E. H. Jones & Co., Cleveland.
Deming Co., Salem, O.
Brightman Stoker Co., Cleveland, O.
Henry R. Worthington, New York City.

Radial Drills—
Bickford Drill & Tool Co., Cincinnati, O.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Rock Breakers—
Bradley Fertilizer Co., Boston, Mass.
Lake Shore Iron Works, Marquette, Mich.
Copeland & Bacon, New York City, N. Y.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
General Engineering Co., Harvey, Ill.
Rippel & King, Canal Dover, O.

Roll Lathes—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg Iron & Steel Foundry Co., Pittsburg, Pa.

Saws—
Peter Gerlach & Co., Cleveland.

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Smokeless Furnaces—
J.V. Burke, Chicago, Ill.
Brightman Stoker Co., Cleveland, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Ravenna Boiler Works, Ravenna, O.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.

Steam Heaters—
United States Heater Co., Detroit, Mich.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.
F. A. Sackman, Cleveland, O.
James Murdock, Jr., Cincinnati, O.

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Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Color Paint—
W. W. Lawrence & Co., Pittsburgh, Pa.

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Sargeant & Co., Chicago, Ill.
Wm. Jessop & Sons, Ltd., New York, N. Y.

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Klein & Cohn, Cincinnati, O.

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Toledo Machine & Tool Co., Toledo, O.
Godfrey J. Bremer, Kalamazoo, Mich.
Cleveland Stamping & Tool Co., Cleveland, O.
Richard O. Jones, Cuyahoga bldg., Cleveland, O.

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Brightman Stoker Co., Cleveland, O.

Steel Mushet's—
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The Beckett Smoke Consuming Co., Norwalk, O.
Northwestern Land & Coal Co., Boston, Mass.
Brightman Stoker Co., Cleveland, O.

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Cleveland Rolling Mill Co., Cleveland.

Stay Bolt Iron—Taylor's—
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Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Tanks—
Aultman & Taylor Mach. Co., Mansfield, O.
Ravenna Boiler Works, Ravenna, O.

Tin Plates (Roofing)—
Merchant & Co., Philadelphia, Pa.

Tinners' Hardware—
Berger Bros, Philadelphia, Pa.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tool Steel—
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The Whitman & Barnes Mfg. Co., Akron, O.

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B. F. Sturtevant Co., Boston, Mass.

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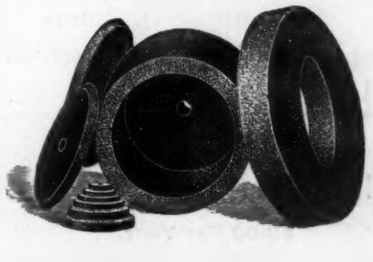

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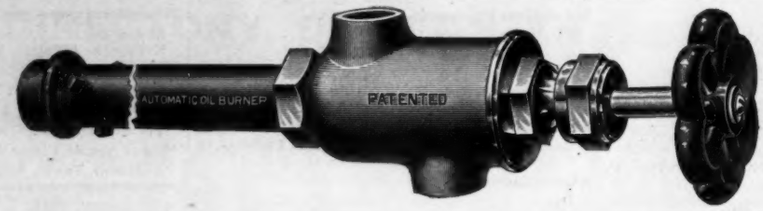

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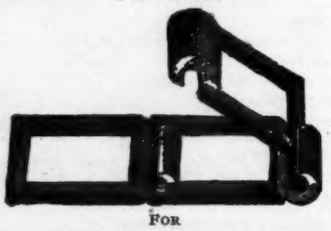

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No. 1 Specular, Bessemer	4.50@ 0.00
No. 1 Bessemer hematite	3.75@ 4.00
Hematites No. 1 non-Bessemer	3.00@ 3.65
No 1. Specular, non-Bessemer	3.50@ 4.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$13 20@$13 40
No. 1 Strong Foundry	13 75@ 14 00
No. 2 Strong Foundry	12 75@ 13 00
No. 1 Grey Forge, red short	11 75@ 12 00
No. 2 Gray Forge, neutral	11 50@ 11 75
No. 1 American Scotch	14 00@ 00 00
No. 2 American Scotch	13 00@ 00 00
Lake Superior Charcoal	16 00
PITTSBURGH (reported by A. H. Childs):	
No. 1 Foundry	$13 50@$13 75
No. 2 Foundry	12 50@ 12 75
Grey Forge	11 75@ 12 25
White and Mottled	11 50@ 11 60
Warm Blast Charcoal	18 00@ 21 00
Cold Blast Charcoal	23 00@ 27 00
Bessemer	13 20@ 13 40
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$16 00@$16 50
Local Coke Foundry No. 1	13 75@ 14 25
Local Coke Foundry No. 2	13 00@ 13 25
Local Coke Foundry No. 3	12 75@ 13 00
Local Scotch Foundry No. 1	14 00@ 15 00
Local Scotch Foundry No. 2	13 50@ 14 00
Local Scotch Foundry No. 3	13 00@ 13 50
Southern Coke No. 1	14 10@ 14 35
Southern Coke No. 2	12 60@ 12 85
Southern Coke No. 3	12 10@ 12 35
Southern No. 1 Soft	12 60@ 12 85
Southern No. 2 Soft	12 10@ 12 35
Southern Silveries No. 1	14 10
Southern Silveries No. 2	13 10
Ohio Silveries No. 1	16 50@ 17 00
Ohio Silveries No. 2	16 25@ 16 75
Ohio Strong Softeners No. 1	16 50@ 17 00
Ohio Strong Softeners No. 2	15 50@ 16 00
Tennessee Charcoal	16 00@ 16 50
Alabama Car Wheel	00 00@ 18 85
CINCINNATI (reported by Rogers, Brown & Co.):	
Southern Coke No. 1, Foundry	$12 75@$13 25
Southern Coke No. 2 and No. 1 Soft	11 50@ 12 00
Hanging Rock Coke, No 1	15 00@ 15 50
Hanging Rock Charcoal No. 1, Fdy	18 50@ 19 50
Tennessee Charcoal No 1	15 50@ 16 00
Jackson County Stone Coal No 1	15 50@ 16 00
Southern Coke, Grey Forge	10 50@ 11 00
" " Mottled	10 25@ 10 50
Standard Alabama Car Wheel	18 00@ 19 00
Tennessee " "	17 00@ 17 50
Lake Superior " "	17 50@ 18 00
BUFFALO (reported by Rogers, Brown & Co.)	
Mahoning and Shenango Valley, strong, No. 1 Foundry	$14 50
Mahoning and Shenango Valley, strong, No. 2 Foundry	13 25
Ohio Softener No. 1	14 00
Ohio Softener No. 2	00 00
Jackson Co. Silvery, No. 1	$17 00@ 17 30
Jackson Co. Silvery No. 2	00 00@ 00 00
Lake Superior Charcoal	16 00
Tennessee Charcoal	16 00
Southern Softener No. 1	13 65
Alabama Car Wheel	18 00
Hanging Rock Charcoal	20 50
LOUISVILLE (reported by Hall Bros. & Co.):	
Southern Coke No. 1	$13 00@$13 25
Southern Coke No. 2	12 00@ 12 00
Southern Coke No. 3	11 25@ 11 50
Southern Charcoal No. 1	15 50@ 16 00
Southern Charcoal No. 2	15 00@ 15 50
Missouri Charcoal No. 1	17 00@ 17 50
Missouri Charcoal No. 2	16 50@ 17 00
Neutral Coke	10 75@ 11 00
Mottled	10 50@ 10 75
Southern (standard brands)	17 50@ 18 50
Southern (other brands)	16 50@ 17 00
Lake Superior	18 00@ 18 50
DETROIT (reported by F. B. Stevens, 74 Griswold St.):	
Southern Coke No. 1 Foundry	$14 10@$14 35
Southern Coke No. 2 Foundry	12 85@ 13 10
Southern Coke No. 3 Foundry	12 10@ 12 35
Southern Coke No. 1 Foundry soft	12 85@ 13 10
Southern Coke No. 2 Foundry soft	12 10@ 12 35
Southern Grey Forge	11 85@ 12 10
Bessemer	15 00@ 15 25
Lake Superior Charcoal No. 1	17 00
Lake Superior Charcoal No. 2	16 00
LOUISVILLE (reported by Geo. H. Hull & Co.)	
Southern Coke No. 1 Foundry	$12 75@$13 25
Southern Coke No. 2 Foundry	11 50@ 12 00
Southern Coke No. 3 Foundry	11 00@ 11 25
Grey Forge	10 50@ 10 75
Spathite	11 50@ 12 50
Southern Charcoal No. 1 Foundry	15 00@ 16 00
Car Wheel	17 50@ 17 75

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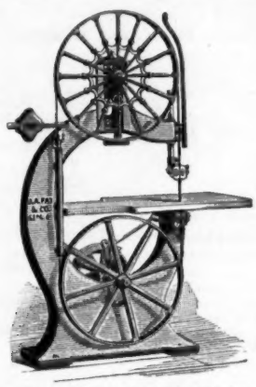

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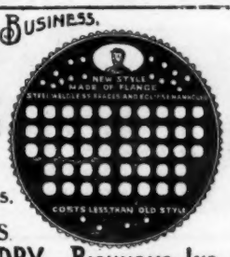

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Southern Coke No 1	$13 25@$13 75
Southern Coke No. 2	12 00@ 12 50
Southern Coke No. 3	11 50@ 11 75
Southern Grey Forge	11 25@ 11 50
Southern Charcoal No. 1	15 50@ 16 00
Missouri Charcoal No. 1	14 00@ 14 50
Ohio Softeners	16 50@ 17 00
Lake Superior	17 50@ 18 00
Southern	18 25@ 18 50
Connellsville Coke, St. Louis	5 65

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	Gross Tons
Old iron rails	$18 50
Old steel rails	13 50
	Net Tons
No. 1 R. R. wrought scrap	$13 00
No. 1 wrought scrap	12 00
No. 1 Machine cast scrap	10 75
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	9 00
Cast borings	6 75
Uncut wrought iron boilers	7 00
Steel boiler Plates	10 00
Grate bars	5 00
Pipes and flues (clean)	9 00
Tank iron	9 50
Hoop and band iron	7 00
Sheet iron	7 00
Wrought drillings	7 00
Malleable iron	8 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.65c@1.75c
Angles	1.55c@1.65c
Tees	1.90c@2.00c
Universal Plates	1.65c
Sheared Plates	1.75c

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 65
4¼ to 6 by ⅜ to 1 inch	1 70
1¾ to 6 by 1⅛ to 2 inch	1 85
1¼ & 1⅜ by ⅜ to ¾ inch	1 70
1 & 1⅛ by ⅜ to ¾ inch	1 75
⅝, ⅜, ⅞, by ⅜ to ⅝ inch	1 85

Round and Square.

1 to 1⅞ inch	1 65
2 to 2⅝ inch	1 75
2¾ to 3¼ inch	1 90
3⅜ to 4 inch	2 15
4¼ to 4½ inch	2 75
4¾ to 5 inch	3 00

Oval.

⅞ to 1¼ inch	1 85
⅝ to ¾ inch	1 85
½	2 05
⅜	2 25

Half Oval and Half Round.

1½ to 3 inch	2 20
⅞ to 1½ inch	2 00
⅝ to ¾ inch	2 25
½	2 40
⅜	3 50

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 75
1 to 1⅜ by ¼ and 5-16 inch	1 80
¾ to ⅞ by ¼ and 5-16 inch	1 90
⅞ to ⅜ by ¼ and 5-16 inch	2 15

Hoops.

1¼ to 4, Nos. 13 to 15	2 40
1¼ to 2, Nos. 16 to 18	2 45
1¼ to 2. No. 19	2 50
1¼ to 2, No. 20	2 50
1¼ to 2, No. 21	2 60
1¼ to 2, No. 22	2 70
15-16, 1 and 1⅛, Nos. 13 to 15	2 45
15-16, 1 and 1⅛, Nos. 16 to 18	2 50
15-16, 1 and 1⅛, Nos, 19 and 20	2 60
15-16, 1 and 1⅛, No, 21	2 70
15-16, 1 and 1⅛, No. 22	2 80
⅞, Nos. 13 to 15	2 60
⅞, Nos. 16 to 18	2 70
⅞, Nos. 19 and 20	2 80
⅞, No. 21	2 90
⅞, No. 22	3 00
13-16, Nos. 13 to 15	2 70
13-16, Nos. 16 to 18	2 80
13-16, Nos. 19 and 20	2 90
13-16 No. 21	3 00
13-16, No. 22	3 10
¾, Nos, 13 to 15	2 80
¾, Nos. 16 to 18	2 95
¾, Nos. 19 and 20	3 00
¾, No. 21	3 10
¾, No. 22	3 25
11-16, Nos. 13 to 15	3 05
11-16, Nos 16 to 18	3 10
11-16, Nos. 19 and 22	3 20
11-16, No. 21	3 30
11-16, No. 22	3 40
⅝, Nos. 13 to 15	3 10
⅝, Nos. 16 to 18	3 20
⅝, Nos. 19 and 20	3 30
⅝, No. 21	3 40
⅝, No. 22	3 50
⅝, No. 23	3 60

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 95
1½ to 6 by Nos. 11 and 12	2 00

Brainard Milling Machine Co.

EXHIBIT AT

- Machinery Hall, World's Fair, -

COLUMN K 39.

Plain and Universal Milling Machines,

Automatic Gear Cutting Machines,

Special Cam Cutting Machines.

These machines can be seen in operation.

WORKS AT HYDE PARK, MASS.

CHICAGO OFFICE, 14 S. Canal St.

BOSTON OFFICE, 156 Oliver St.

RAU M'F'G. CO.,

MANUFACTURERS OF

Copper, Brass and Tin Oilers,

Of all Descriptions, also

Torches, - -

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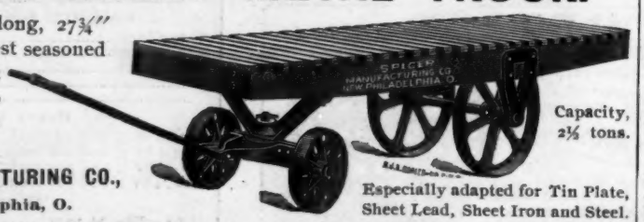
128 Michigan St., CHICAGO, ILL.

SPICER SHEET METAL TRUCK.

Platform, 90" long, 27¾" wide; made of best seasoned hickory, with slat top. Weight, 350 pounds. For particulars address

SPICER MANUFACTURING CO.,
New Philadelphia, O.



Capacity, 2½ tons.

Especially adapted for Tin Plate, Sheet Lead, Sheet Iron and Steel.

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HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE

Known to the Arts.

POWDER, FUSE, CAPS,

Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

1 to 1¾ by ⅛ to 3-16 inch	2 00
1 to 1¾ by Nos. 11 and 12	2 05
⅞ and 13-16 by ⅛ to 3-16 inch	2 15
⅞ and 13-16 by Nos. 11 and 12	2 20
¾ and 11-16 by ⅛ to 3-16 inch	2 25
¾ and 11-16 by Nos. 11 and 12	2 30
⅝ and 9-16 by ⅛ to 3-16 inch	2 40
⅝ and 9-16 by Nos. 11 and 12	2 45
½ by ⅛ to 3-16 inch	2 55
½ by Nos. 11 and 12	2 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 20
⅞ inch, " " " " 13 and 14	2 30
¾ inch, " " " " 11 and 12	2 35
¾ inch, " " " " 13 and 14	2 55

Sheet Iron.

No. 10 to 14	2 30
No. 15 to 17	2 45
No. 18 to 21	2 60
No. 22 to 24	2 70
No. 25 to 26	2 80
No. 27	2 90
No. 28	3 55

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1, " "	2 50
C H Flange, " "	3 50
Extra Flange "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	specia

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	08
9-16 to ½ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in.	09
3⅛ to 4 in.	09½
⅝ to 11-16 and 4⅛	10
⅛ to 6 in.	10½
¾ to 9-32 and 6⅛ to 7 in.	11
3-16 in	13

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery	base price, 2 35
Tire	" 2 25
Spring	" 2 80
Sleigh Shoe	" 2 50
Toe Calk	" 2 35
Cutter Shoes, tapered and bent	" 2 75

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

MACHINERY SUPPLY MARKET.

Anvils.

American	₱ lb 9@10
Wright's	₱ lb 12

Bellows.

Blacksmiths'	Hill's dis 40
	Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 45
Munson's Short Lap Double and Light Double Leather	dis 50
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 30
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

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Welles Building,
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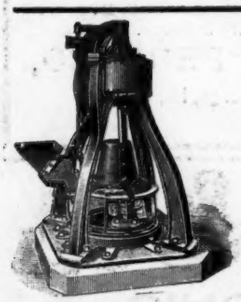
THE FOOS MFG. CO. SPRINGFIELD, OHIO.



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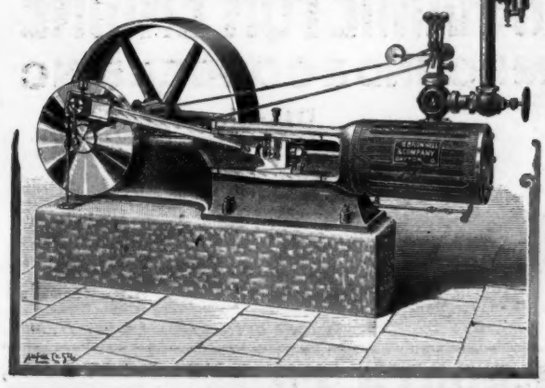
The Brownell & Company



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Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

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FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₱ 3½
Iron, steel points	₱ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150 gr.	Flour, C. F. F. FF.
Kegs, ₱ lb	4½c	5 c	2½c
½ kegs ₱ lb	4¾c	5¼c	2¾c
¼ kegs ₱ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 55@60
Norton's	dis 55@60
Grant	dis 55@60
Sterling	dis 60
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60
Vulcanite	dis 60&10
Hamden	dis 60&10
Cyclone	dis 60

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs.	15c
" " " " over 5 lbs.	12c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¾	3½
Hexagon	15½	11½	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₱ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 75
Standard Penny Nails, ₱ keg card rate	
{ Car lots	$1.55
{ Less than car lots	$1.60

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₱ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co.	dis 60
American Packing Hemp	₱ lb 9@10
Russia " "	₱ lb 14
Italian " "	₱ lb 13@19
Plumbago Piston	₱ lb 40
Peerless	₱ lb 60
Morrison's "	₱ lb 50
Square Flax "	₱ lb 50
Sheet Rubber	₱ lb 12&24
Excelsior Rubber	₱ lb 48
Rainbow { Full Rolls	45c ₱ lb
Rainbow { Less than Full Rolls	50c ₱ lb
Eclipse Gasket	₱ lb 75

Picks.

Railroads, 5 to 6 lbs.	$12 dis 60
" 6 to 7 lbs.	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 40
Medart Pulleys	dis 50
Split Wood Pulleys	dis 50@55

Rivets.

Iron, Thousand, list November 17	dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17	dis 50&10@60
Copper	dis 50@50&10

Saws.

Disston's Circular	dis 40&10
" Band	dis 25
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Diston's	dis 30
Atkins' Circular Saws	dis 40&45
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	70c per ft
" Dexter Cross-cuts	50c "
" Diamond "	30c "
" Tuttle Tooth Cross-cuts	25c "
" One-man Cross-cuts	32c "

No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Perfection "	$15 "
Detroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " "	new list...dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Jan. 18, 1884

Brass	dis 30
Coppet	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ℔ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Bolt and Nut Works.

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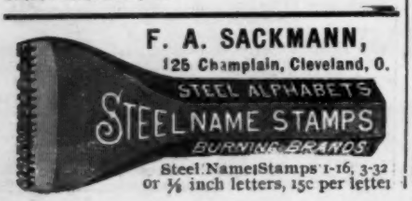

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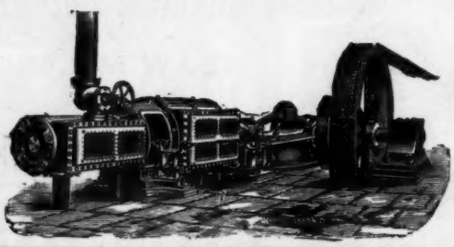

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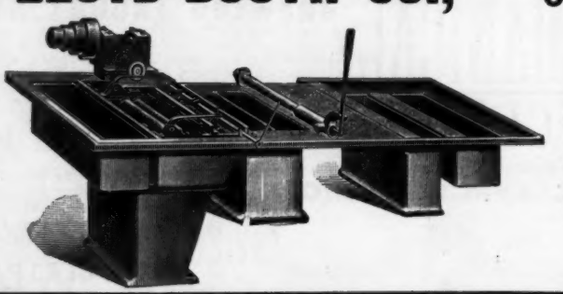

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From 1 to 100 horse-power. } **Can be Used in City or Country.**

In conjuction with our Producer Gas Apparatus, we guarantee coal consumption of 1½ pounds per hour per h.p.

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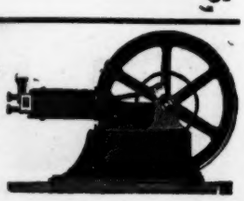

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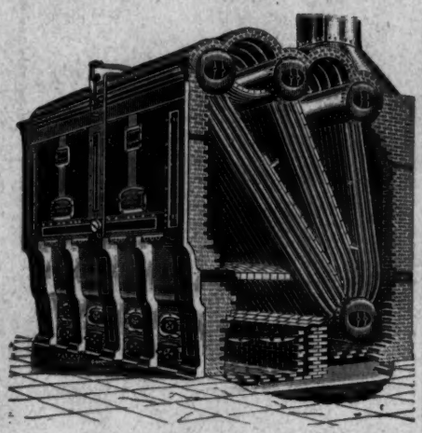

Is economical in fuel and repairs, practically self cleaning. Four manholes give access to every tube. It will pay you to investigate before purchasing elsewhere. - - - - -

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Cleveland & Buffalo Transit Co.

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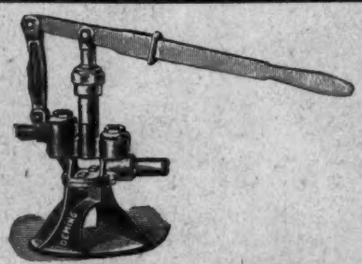
FIG. 3. Write for catalogue and prices.

FIG. 25.



Hydraulic Boiler Test Pump. Fig 566.

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For HAND AND POWER.

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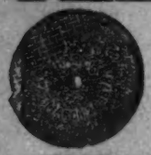

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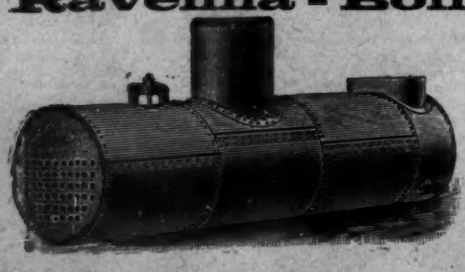

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